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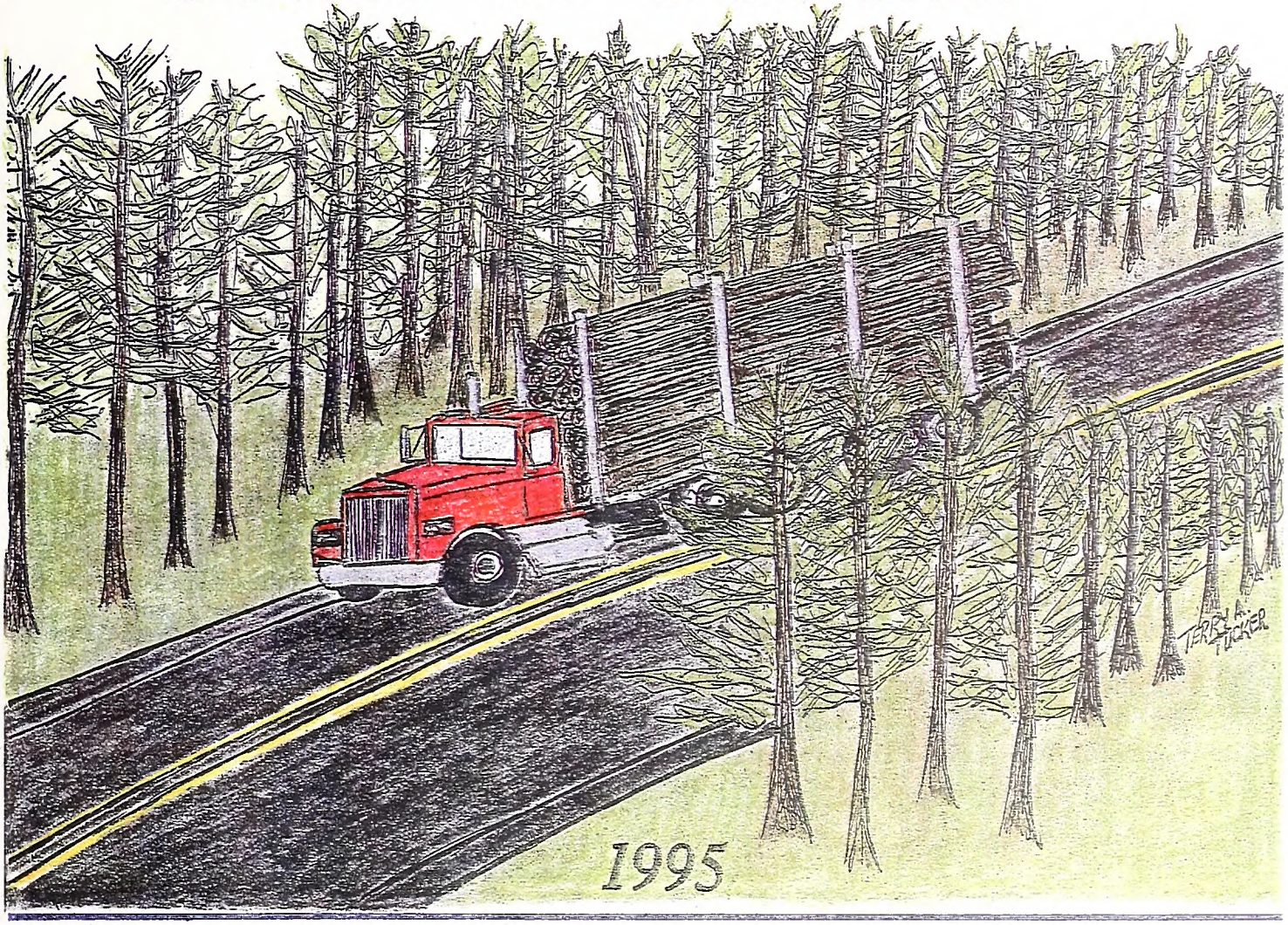
North Carolina Department of Transportation
Division of Highways
Statewide Planning Branch

THOROUGHFARE PLAN FOR THE TOWN OF BURGAW



THOROUGHFARE PLAN
FOR THE
TOWN OF BURGAW

Prepared by the:

Statewide Planning Branch
Division of Highways
N. C. Department of Transportation

In cooperation with:

The Town of Burgaw
The Federal Highway Administration
U. S. Department of Transportation

September, 1995

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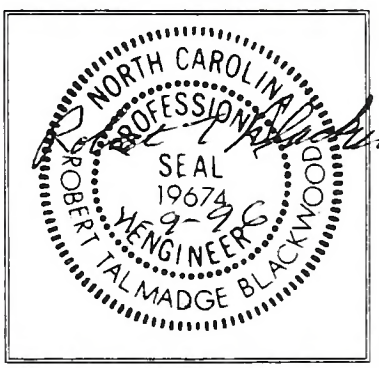

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1. INTRODUCTION

A well planned transportation system is an asset to the economic and social well being of a growing community. It provides the means to transport people and goods from one place to another quickly and conveniently. A good highway system must not only meet existing travel demands, but also keep pace with the development of the region. This report will set a system of major roads and highways required to satisfy the anticipated needs of Burgaw for the next twenty five years. Certain priorities shall be established in the development of the thoroughfare system. These priorities will be based on maintenance needs, bridge inadequacies, poor alignments, and insufficient present and future roadway capacities.

The proposed Burgaw Thoroughfare Plan was developed following the basic principles of thoroughfare planning as described in Chapter 8 of this report. The plan recommends those improvements that are felt to be essential for proper traffic circulation within the 1995-2020 planning period.

Burgaw can provide assistance in the implementation of the plan through subdivision regulations and zoning ordinances. It will be desirable for the plan to be formally adopted by both the Town Commissioners and the North Carolina Department of Transportation to serve as an official guide in providing a well coordinated, adequate, and economical major thoroughfare system.

It should be emphasized that the recommended plan is based on anticipated growth of the area as indicated by current trends. Design requirements and exact project locations should be based on detailed studies of each project on an individual basis.

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2. THOROUGHFARE PLAN

A thoroughfare plan study uncovers the need for new facilities, plus identifies existing and future deficiencies in the transportation system. The thoroughfare plan is a representation of the existing highway system by functional use, e.g.; major thoroughfares, minor thoroughfares, plus any new facilities that are needed. The planning methodology enables identification of deficiencies in the existing system, allowing compilation of a list of needed improvements.

This chapter presents an analysis and makes recommendations based on the ability of the existing street system to serve present and future travel desires as the area continues to grow. The usefulness of transportation planning is in the analysis of different highway configurations for their efficiency in serving the area. The recommended plan sets forth a system of thoroughfares to serve the anticipated traffic and land development needs for the Burgaw area. The need to eliminate existing and projected system deficiencies that cause traffic congestion is the primary objective of the plan.

The thoroughfare plan outlines the transportation system network according to each roadway's function within the system. Each road in the thoroughfare plan was evaluated based on the following factors: alignment, capacity, width, number of lanes, projected 2020 traffic volume, existing and future land use patterns, environmental impacts, and pavement structure. Suggestions for the improvement of roads are made based on these factors. Also, aerial photography, topographic mapping, field reconnaissance, and discussions with local staff, officials, and local citizens provided additional basis for identifying and evaluating alternate alignments. The recommended thoroughfare plan for Burgaw is shown in figure **2-A** and detailed in appendix **A**.

Elements of the Burgaw Thoroughfare Plan are as follows:

Freeway System

A freeway is a divided, controlled access facility. Its purpose is to provide uninterrupted flow for traffic. The following is the only freeway in the planning area.

I-40

Freeway Recommendations

The capacity of the section of I-40 that passes through the Burgaw planning area is greater than the 2020 projected traffic for this section. Therefore, this report makes no recommendations for I-40.

Major Thoroughfare System

Major thoroughfares serve as the primary movers of traffic in the urban area. The following is a list of major thoroughfares.

US 117 Business
US 117 Bypass
NC 53 Business
NC 53 Bypass
SR 1214 Dickerson
SR 1216 Piney Woods Rd
SR 1332 Penderlea Hwy
SR 1340 New Savannah Rd
SR 1343 Henry Brown Rd
SR 1344 Wallace St
SR 1345A Old Savannah Rd
SR 1400 Highsmith Rd
SR 1510 Wilmington St
SR 1551 Bridgers St
SR 1557 Smith Ave
Progress Dr
Wright St
McNeil St

Major Thoroughfare Recommendations

The first recommendation is a bypass of the central business district (CBD). This will allow through traffic to avoid this area, lessening the downtown congestion. As an added bonus, the bypass will also remove much of the truck traffic in Town, increasing the capacity as well as the safety of the downtown streets. The location of the recommended bypass is shown in **figure 2-A** of this report.

An urban loop is also recommended. This project seems favorable because the majority of the loop is already in place. Using existing streets saves on construction and right-of-way cost, and avoids disruption of personal and business properties. Burgaw currently has a radial street system. This causes traffic to flow through the central part of Town, where the radials converge. A loop allows traffic to travel from the radial streets to different parts of Town without passing through the center of Town. The loop will lessen the congestion in the center of Town, allow for easier access to NC 53 and US 117, and lessen travel time from various points to Burgaw's Hospital. To make travel to southbound I-40 more accessible, a connection from the loop and US 117 to I-40 was requested by several members of the Burgaw Planning Board.

NC 53 should be widened to a five lane curb and gutter section from I-40 to the NC 53 Bypass. The normal projected growth of the area, coupled with the increase in traffic caused by the bypass and new frontage road will cause this section to be over capacity unless it is widened.

Minor Thoroughfare System

Minor thoroughfares serve local traffic within the urban area. The following is a list of minor thoroughfares.

SR 1208 Hayes Rd
SR 1343 Henry Brown Rd
SR 1431 Clark St
SR 1509 Stag Park Rd
SR 1557 Smith Ave
Dickerson St
Dudley St
Freemont St
McNeil St
Walker St
Williams St
Wright St

Minor Thoroughfare Recommendations

A road connecting NC 53 with Stag Park Road (SR 1509) near I-40 would provide interstate access for this growing industrial section, as well as make it a more attractive location for businesses and factories.

Other Recommendations

The removal of parking on certain downtown streets may also be necessary. This will allow the entire width of the street to be used for traffic flow, increasing the capacity of the street. Removal of parking will benefit Wilmington St. from NC 53/US 117 to Smith St., and Freemont St. from Cowan St. to Smith St. A complete listing of all recommendations may be found in **Appendix A.**

FIGURE 2-A

LEGEND

	existing	proposed
Freeway		
Major Thoroughfare		
Minor Thoroughfare		
Interchange		
Grade Separation		
Planning Area		

Adopted by:

Burgaw 11-28-95

Recommended by Statewide Planning Branch 12-06-95

NC Dept. of Transportation 1-05-96

Public Hearing: 11-28-95

Map Date 11-01-95

N

BURGAW

PENDER COUNTY

NORTH CAROLINA

Prepared by the
North Carolina Department of Transportation
Division of Highways-Statewide Planning Branch
In cooperation with
U.S. Department of Transportation
Federal Highway Administration

BASE: 1993

3. IMPLEMENTATION

There are several methods through which a local government may implement a Thoroughfare Plan. Suggested methods for the projects in the Burgaw Thoroughfare Plan are listed below and are summarized in Table **3-1.** The remainder of this chapter describes the various methods.

Burgaw Thoroughfare Plan: Suggested Project Implementation

The following text lists each of the recommended projects, their estimated cost, and a recommended method of implementation. The recommendations of this chapter are summarized in Table **3-1**. In addition, a cost benefit comparison is provided in Table **3-2**. For all projects, it is recommended that the Town use its local subdivision regulations and zoning ordinances in conjunction with the Thoroughfare Plan to preserve corridors and prevent encroachment of development that could prevent, or increase the cost of, construction.

1. Burgaw By-pass - $ 8,100,000 ($6,000,000 Construction, $2,100,000 Right of Way). This project currently appears in the State TIP as scheduled for construction.

2. NC 53 Widening - $ 2,200,000 (Initial Estimate, $1,500,000 Construction, $ 700,000 Right of Way). Due to growth in the area, NC 53 will need to be widened to a multi-lane section from I-40 to the NC 53 bypass. The best source of funding for this project is the State TIP.

3. Urban Loop - $7,600,000 (Initial Estimate, $6,600,000 Construction, $1,000,000 Right of Way)
   Land for this project should be protected by use of the Thoroughfare Plan, as well as zoning and subdivision ordinances. Funding could be provided through the State TIP, as well as by the Town of Burgaw.

4. Frontage Rd - $1,300,000 (Initial Estimate, $1,200,000 Construction, $100,000 Right of Way)
   Use Thoroughfare Plan and development review to preserve corridor. Optimum funding sources would be the State TIP as well as industrial access funds.

5. I-40 Connector - $9,400,000 (Initial Estimate)
   ($7,200,000 For US 117 to I-40; $2,200,000 Progress to US 117). Zoning, subdivision ordinances, and the Thoroughfare Plan may all be utilized to preserve the corridor to allow a connection between US 117, Burgaw's loop, and I-40.

Implementation Methods
State-Municipal Adoption of the Thoroughfare Plan

Both the Town of Burgaw and the North Carolina Department of Transportation have responsibility for implementation of the Burgaw Thoroughfare Plan. Chapter 136, Article 3A, Section 136-66.2 of the North Carolina General Statutes provides that after development of a Thoroughfare Plan, the plan may be adopted by the governing body of the municipality and the Board of Transportation as the basis for future street and highway improvements. After mutual adoption, negotiations will begin to determine which of the existing and proposed thoroughfares will be a Department of Transportation responsibility and which will be a municipal responsibility. Facilities which are designated as State responsibility will be constructed and maintained by the Division of Highways; however, the municipality may share in the right-of-way cost. This share of costs will be determined at the time of construction.

In general, the State is responsible for those facilities which will be serving major volumes of through traffic and traffic from outside the area to major commercial, industrial, and institutional areas inside the municipality. Those facilities which will serve primarily internal traffic are to be a municipal responsibility.

Administrative controls and implementation methods that can aid in the implementation process are generally available to municipalities through Federal and State legislation. These controls and methods include, but are not limited to: subdivision regulations, zoning ordinances, official maps, urban renewal, capital improvements programs, and development reviews. Generally, two issues play a major role in the implementation process; available finances and citizen involvement. Effective use of the controls and methods listed above are indicative of good planning and minimize the effect of limited finances and negative citizen reaction to specific elements of the plan. It is through good planning that maximum use is made of every available dollar and that citizen involvement and approval of the Thoroughfare Plan is obtained.

Subdivision Regulations

Subdivision regulations require every subdivider to submit to the local planning commission a plan of his proposed subdivision and requires that the subdivision be constructed to certain standards. Through this process, it is possible to require the subdivision streets to conform to the Thoroughfare Plan and to reserve or protect necessary rights-of-way for projected roads and highways that are to become a part of the Thoroughfare Plan. The construction of subdivision streets to adequate standards would reduce maintenance costs and would facilitate the transfer of the

streets to the State Highway System. Appendix B outlines the recommended design standards.

Roadway Corridor Official Map

North Carolina General Statutes 136-44.50 through 133-44.53 are collectively designated as the "Roadway Corridor Official Map Act." For cities contemplating the adoption of a Roadway Corridor Map, more commonly referred to as an Official Street Map, there are several things to consider prior to implementation. First and foremost, it should be recognized that an Official Street Map places severe, but temporary, restrictions on private property rights. These restrictions are in the form of a prohibition, for a period of up to three years, for the issuance of building permits or subdivision of property lying within an Official Street Map corridor. This authority should be used carefully and only in cases where less restrictive powers will be ineffective.

The Statute establishing the Official Street Map authority is fairly explicit in outlining the procedures to be followed and the types of projects to be considered. As required by the Statute, a project being considered for an Official Street Map must be programed in the State's Transportation Improvement Program (TIP) **or** included in a locally adopted capital improvement plan, in addition to appearing on the adopted street system plan. The Statute states that the capital improvement plan must be for a period of ten years or less, and must identify the estimated cost of acquisition and construction of the proposed project as well as the anticipated financing.

The Program and Policy Branch of the North Carolina Department of Transportation is responsible for facilitating the adoption of Official Street Maps. Cities considering Official Street Map projects should contact the Program Development Branch for their "Guidelines for Municipalities Considering Adoption of Roadway Corridor Maps" at:

Program Development Branch
NC Department of Transportation
P.O. Box 25201
Raleigh, NC 27611

Zoning

A zoning ordinance can be beneficial to thoroughfare planning in that planned locations of various land uses and planned densities of dwellings can be realized. This provides a degree of stability on which to make future traffic projections and to plan streets and highways.

Other benefits of a good zoning ordinance are: **(1)** the establishment of standards of development which will aid traffic operations on major thoroughfares, and **(2)** minimizing strip commercial development which creates traffic friction and increases the traffic accident potential.

Urban Renewal

Urban renewal is defined as the rehabilitation of downtown areas by demolishing, remodeling, or repairing existing structures in accordance with comprehensive plans. This process allows for corrections to basic problems in the street system layout and design.

To qualify for community development funds or discretionary funds for urban renewal, a city must first prepare a community development program. Urban areas compete throughout the State on the basis of demographic points which consider such conditions as percent of substandard housing, people per square feet of housing, dwelling unit age, etc. An effort can be made to ensure that community development and transportation plans are compatible.

Capital Improvements Program

One of the tools which makes it easier to build a planned thoroughfare system is a Capital Improvements Program. This is a long range plan for the spending of money on street improvements, acquisition of right-of-way, and other capital improvements within the bounds of projected revenues. Municipal funds should be available for construction of street improvements which are a municipal responsibility, right-of-way cost sharing on facilities designated as Division of Highways responsibility, and advance purchase of right-of-way where such action is required.

The section of the Capital Improvements Program which deals with the Thoroughfare Plan requires a fairly detailed knowledge of the costs of various projects. This program could be used to benefit any of the improvements listed in this plan.

Development Reviews

Driveway access to a State-maintained street or highway is reviewed by the District Engineer's office and by the Traffic Engineering Branch of the North Carolina Department of Transportation prior to access being allowed. Any development expected to generate large volumes (i.e. shopping centers, fast food restaurants, large industries, etc.) may be comprehensively studied by staff from the Traffic Engineering, Statewide Planning, and Roadway Design Branches of NC DOT. If done at an early stage, it is often possible to significantly improve the development's accessibility at minimal expense. Since the municipality is the first point of contact for developers, it is important that the municipality advise them of this review requirement and cooperate in the review process.

Other Funding Sources

1. Assess user impact fees to fund transportation projects. These fees, called "facility fees" in the legislation, are to be based upon "reasonable and uniform considerations of capital costs to be incurred by the town as a result of new construction. The facility fee must bear a direct relationship to additional or expanded public capital costs of the community service facilities to be rendered for the inhabitants, occupants of the new construction, or those associated with the development process."

2. Enact a bond issue to fund street improvements.

3. Have project included in the North Carolina Transportation Improvement Program (TIP). North Carolina's TIP is a document which lists all major construction projects the Department of Transportation plans for the next seven years. Similar to local Capital Improvement Program Projects, TIP projects are matched with projected funding sources. Each year when the TIP is updated, completed projects are removed, programed projects are advanced, and new projects are added.

   During annual TIP public hearings, municipalities request projects to be included in the TIP. A Board of Transportation member, Division Engineer, and DOT Staff review all of the project request in a particular area of the State. Based on the technical feasibility, need, and available funding, it is decided which projects will be included in the TIP. In addition to highway construction and widening, TIP funds are available for bridge replacement projects, highway safety projects, public transit projects, railroad projects, and bicycle projects.

4. Consider the possibility of specific projects qualifying for federal demonstration project funds.

5. Adopt a collector street plan that would assess buyer or property owners for street improvements.

6. Charge a special assessment for utilities; for example, increase water and sewer bills to cover cost of street improvements.

7. Industrial Access Funds. If an industry wishes to develop property that does not have access to a state maintained highway and certain economic conditions are met, then funds may be made available for construction of an access road.

8. Small Urban Funds. Small Urban funds are annual discretionary funds made to municipalities with qualifying projects. The maximum amount is $300,000 per year per project. A town may have multiple projects. Requests for Small Urban Fund assistance should be directed to the appropriate Board of Transportation member and Division Engineer.

TABLE 3-1

FUNDING SOURCES & METHODS RECOMMENDED FOR IMPLEMENTATION OF PROJECTS

PROJECT	FUNDING SOURCES				METHODS OF IMPLEMENTATION				
	Local Funds	TIP Funds	Indust. Access	Small Urban	T-fare Plan	Subdiv. Ord.	Zoning Ord.	Future Street Lines	Development Review
NC 53 Bypass		X			X			X	X
NC 53 - Widening		X			X				
Frontage Rd (NC 53 to SR 1509)		X	X		X	X	X	X	X
Urban Loop	X	X			X	X	X	X	X
Freemont St. Ext.	X	X			X			X	X
Hayes St. Ext.	X	X			X			X	X
Wallace St. Ext	X	X			X			X	

TABLE 3-2

BENEFIT COMPARISON FOR BURGAW PROJECTS

SECTION	LENGHT KM	LENGHT MI	1994 COST ($ 1000) CONST.	1994 COST ($ 1000) ROW	BENEFITS ($ 1000)	ECONOM IMPACT	ENVIRON. IMPACT +	ENVIRON. IMPACT -
NC 53 BYPASS	8.2	5.1	7000	1300	308100	0.25	0.21	0.14
NC 53 WIDENING I-40 TO NC 53 BYPASS	1.0	0.6	1500	700	23800	0.13	0.14	0.07
I-40 CONNECTOR US 117 TO I-40	1.4	0.9	5900	4200	389900	0.50	0.14	0.14
FRONTAGE RD STAG PARK TO NC 53	1.0	0.6	1200	200	51600	0.25	0.21	0.14
URBAN LOOP US 117 TO PROGRESS	1.9	1.2	1300	100	6000	0.19	0.36	0.07
URBAN LOOP PROGRESS TO WALLACE	2.7	1.7	2900	500	2600	0.19	0.36	0.07

4. TRAVEL DEFICIENCY ANALYSIS OF EXISTING SYSTEM

This chapter presents an analysis of the ability of the existing street system to serve the area's travel desires. Emphasis is placed not only on detecting the deficiencies but on understanding their cause. Travel deficiencies may be localized and the result of substandard highway design, inadequate pavement width, or intersection controls. Alternately, the underlying problem may be caused by the system deficiency such as the need for a bypass, loop facility, construction of missing links, or additional radials.

Existing Travel Patterns

An indication of the adequacy of the existing major street system is a comparison of the traffic volumes with the ability of the streets to move traffic freely at a desirable speed. The ability of a street to move traffic freely, safely, and efficiently with minimum delay is controlled primarily by the spacing of major devices utilized. Thus, the ability of a street to move traffic can be increased by restricting parking and turning movements, using proper sign and signal devices, and by the application of other traffic engineering techniques.

Capacity is the maximum number of vehicles that has a reasonable expectation of passing over a given section of a roadway in one direction, or in both directions, during a given period under prevailing roadway and traffic conditions.[1] The relationship of traffic volumes to the capacity of the roadway will determine the **level of service** being provided. Six levels of service have been selected for analysis purposes. They are given letter designations from A to F with level-of-service (LOS) A representing the best operating conditions and LOS F the worst.

The six levels of service are illustrated in **figure 4-A**, and are defined in this chapter. The definitions are general and conceptual in nature, but may be applied to urban arterial levels of service. Levels of service for interrupted flow facilities vary widely in terms of both the user's perception of service quality and the operational variable used to describe them. The 1985 Highway Capacity Manual contains more detailed descriptions of the levels of service defined for each facility type. For our analysis, capacity is assumed to be LOS D for existing roads. New roads are given a cross section such that a minimum of LOS C would exist in the planning year.

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1. Highway Capacity Manual, Special Report 209, 1-3, 1985

Level of service A describes primarily free-flow operation at speeds around 90 percent of the free-flow speed for the arterial class. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Stopped delay at signalized intersections is minimal.

Level of service B represents reasonable unimpeded operation at speeds around 70 percent of the free flow speed for the arterial class. The ability to maneuver within the traffic stream is only slightly restricted and stopped delays are not bothersome. Drivers are not generally subjected to appreciable tension.

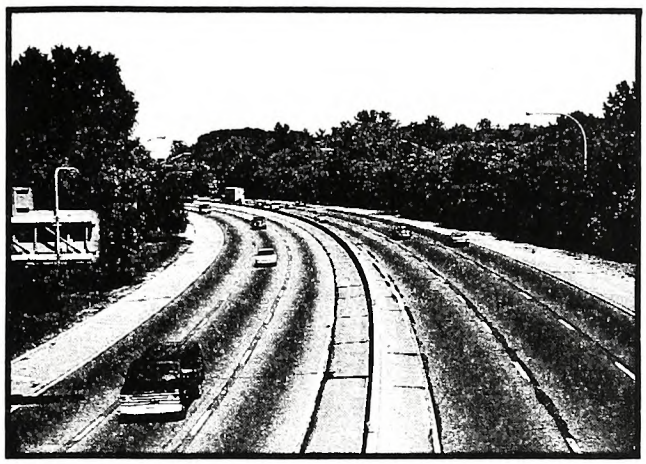
Level of service C represents stable operations. However, ability to maneuver and change lanes in mid-block locations may be more restricted than in level of service B, and longer queues and/or adverse signal coordinations may contribute to lower average travel speeds of about 50 percent of the average free flow speed for the arterial class. Motorists will experience an appreciable tension while driving.

Level of service D borders on a range on which small increases in flow may cause substantial increases in approach delay and, hence decreases in arterial speed. Delay may be due to adverse signal progression, inappropriate signal timing, high volumes, or some combination of these. Average travel speeds are about 40 percent of free flow speed.

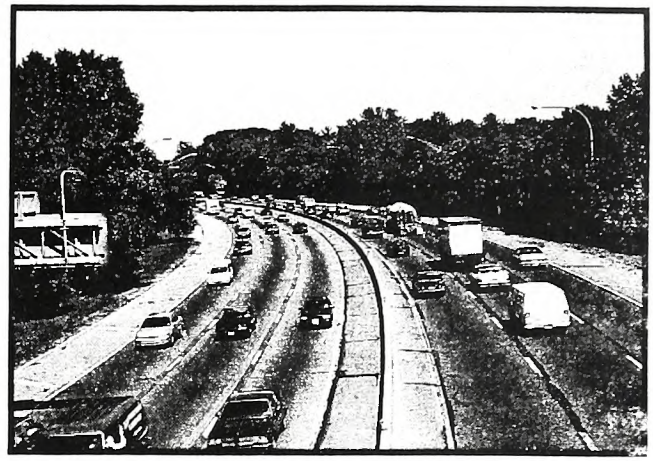
Level of service E is the level at which operations are extremely unstable, because there are almost no gaps in the traffic stream. Any disruption in the traffic stream, such as a vehicle entering from a ramp, or changing lanes requires the following vehicles to give way to admit the vehicle. This condition establishes a disruption wave which propagates through the upstream traffic flow. The boundary between LOS D and LOS E describes operation at capacity. At capacity, the traffic stream has no ability to dissipate any disruption. Any incident can be expected to produce serious breakdown with extensive queuing.

Level of service F describes forced or breakdown flow. The arterial flow is at extremely low speeds; below one third to one fourth of the free flow speed. Intersection congestion is likely at critical signalized locations, with high approach delays resulting. Adverse progression is frequently a contributor to this condition.

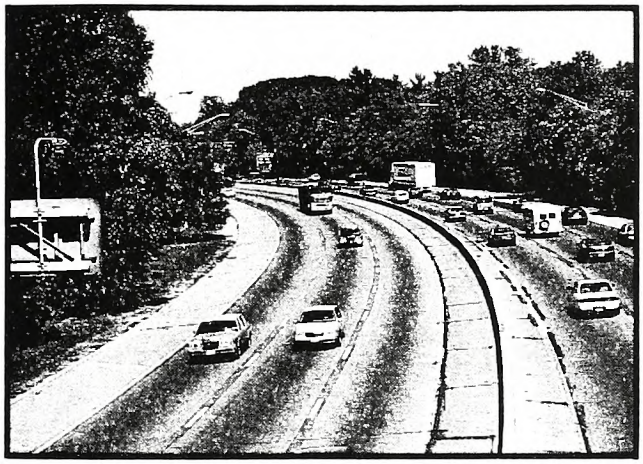
Source: 1994 Highway Capacity Manual



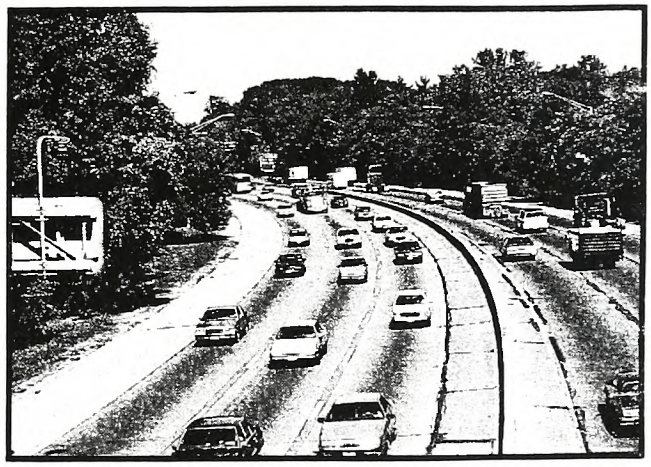
LOS A.



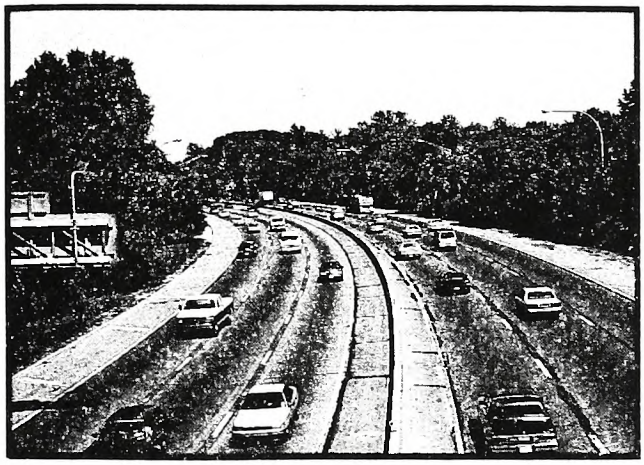
LOS D.



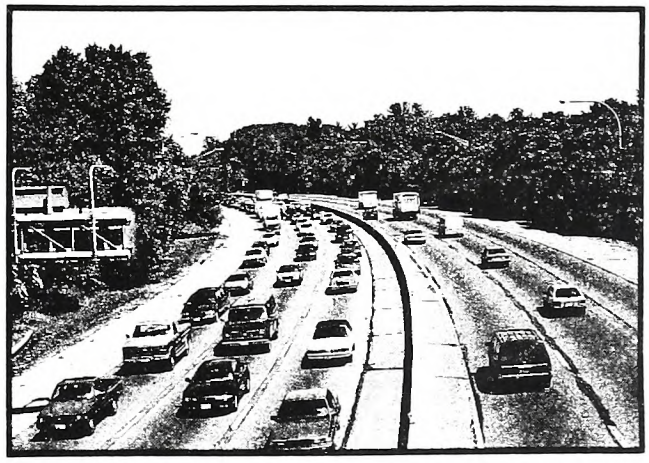
LOS B.



LOS E.



LOS C.



LOS F.

LEVELS OF SERVICE

Capacity, Safety, and Alignment Deficiencies

North Carolina's standards for highway construction call for 3.3 meter (11 foot) lanes on all highways with traffic volumes greater than 2000 ADT (average daily traffic), or design speeds greater than 90 km/h (55 Mph). A 2.4 meter (9 foot) lane width may be used on collector roads with an ADT of less than 400 vehicles per day. The minimum level of service for minor collector roads requires a 40 Mph average overall travel speed during peak traffic conditions.

TABLE 4-1

Minimum Tolerable Lane Widths			
ADT	Principal Arterials m (ft)	Minor Arterials m (ft)	Collectors m (ft)
over 2000	3.3 (11)	3.3 (11)	3.3 (11)
400-2000	--	3.0 (10)	3.0 (10)
100- 400	--	3.0 (10)	2.7 (9)
below 100	--	--	2.7 (9)

When the 2020 traffic projections were compared to the current capacities, a few sections were found to be over (or close to over) capacity (see **figure 4-B**). The first is Wilmington Street from Cowan Street to Smith Street. Freemont Street, from Cowan Street to Smith Street, was also a concern. Also, NC 53 from I-40 to Stag Park Road (SR 1509) and from US 117 bypass to Wilmington Street will reach or exceed its practical capacity.

The construction of the NC 53 bypass, and widening NC 53 to a multi-lane section from I-40 to the bypass will remove enough traffic from the roads listed above to allow them to operate at an acceptable level of service. The capacity and projected Average Daily Traffic (ADT) of each road in the system is listed in **Appendix A** of this report.

In addition to capacity deficiencies, there are also two sections of road where the alignment causes a reduction in service. A curve in NC 53 near Walkertown Road (SR 1430) reduces the sight distance near the intersection. Also, a curve exists on New Savannah Road (SR 1340) which reduces the sight distance in this residential area.

High Accident Intersection Locations.

Traffic accident records aid in defining problem areas and often pinpoint a deficiency such as poor design, inadequate signing, ineffective parking, or poor sight distance. Accident patterns developed from analysis of accident data can lead to improvements to reduce the number of accidents.

Both the severity and number of accidents should be considered when investigating accident data. The severity of every accident is measured with a series of weighting factors developed by NCDOT's Division of Highways. In terms of these factors, a fatal or incapacitating accident is 47.7 times more severe than one involving only property damage. An accident resulting in minor injury is 11.8 times more severe than one with only property damage. Table 4-2 is a summery of accidents in Burgaw from January 1992 thru December 1994. Only intersections with 10 or more accidents during this period are included.

The "Total" column is the total number of accidents within 100 feet of the intersection during the indicated period. The severity listed is the average accident severity for that location.

TABLE 4-2

BURGAW
High Accident Intersection Locations

Road	At	Total	Severity
US 117	NC 53	20	18.38

This intersection warrants further study to determine the cause, and possible solutions. This, however, is beyond the scope of this study.

FIGURE 4-B

2020 CAPACITY DEFICIENCIES

LEGEND

- OVER CAPACITY
- NEAR CAPACITY

N

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PENDER COUNTY
NORTH CAROLINA

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Bridge Conditions

In addition to all the inconveniences that bridge failures cause, they also represent the greatest risk of all highway failures for loss of life. For this reason it is important that bridges be built to the same standards as the highway system they serve.

The North Carolina DOT's Bridge Maintenance Unit, along with consultants, has inspected every bridge on the State Highway System. During this inspection, a sufficiency rating was assigned to each bridge. Factors used in determining the sufficiency rating include structural adequacy and safety, serviceability and functional obsolescence, essentialness for public use, structure type, and traffic safety features. The result is in percentage form with 100 % being entirely sufficient. A rating of 50 % or less qualifies a bridge for Federal Replacement Funds under the National Bridge Inspection Program (Federal Highway Act 1968).

Listed below are all bridges in Pender County with a sufficiency rating of 50 % or less.

TABLE 4-3

#	Facility	Over	Location	Rat	
11	NC 11	Moore's Creek	0.7 Mi S of SR 1121	11.6	*
115	SR1523	Holly Shelter Creek	0.4 Mi S of NC 53	21.2	*
114	SR1561	Bekkie's Creek	0.2 Mi N of SR 1563	22.4	*
21	NC 210	NE Cape Fear River	2.8 Mi E of US 117	24.2	
9	SR1120	Long Creek	2.6 Mi E of us 421	24.3	*
146	SR1304	Doctors Creek	0.3 Mi N of SR 1303	28.5	*
147	SR1304	Doctors Ck Overflow	0.1 Mi N of SR 1303	28.5	*
16	NC 50	Inland Waterway	0.4 Mi N of NC 210	29.3	
68	SR1306	Sills Creek	1.1 Mi W of SR 1308	29.8	
55	SR1209	Cypress Creek	3.4 Mi E of US 42	31.8	
63	SR1305	Doctors Creek	0.8 Mi N of SR 1001	34.1	
116	SR1520	Shaken Creek	2.3 Mi N of SR 1522	35.6	
17	SR1103	Lyon Creek	1.0 Mi S of SR 1104	35.8	
81	SR1216	Cypress Creek	0.8 Mi W of SR 1338	38.3	*
79	SR1336	Long Creek	0.5 Mi S of NC 53	38.5	
96	SR1520	Ashes Creek	0.2 Mi S of SR 1522	39.1	*
47	SR1206	White Oak Swamp	0.3 Mi S of SR 1209	40.7	
144	SR1102	Colley Creek	0.2 Mi N of NC 210	40.8	
37	NC 53	Angola Creek	2.0 Mi W of NC 50	42.7	
48	SR1207	White Oak Creek	0.8 Mi S of SR 1209	45.3	
32	SR1128	Moore's Creek Branch	1.4 Mi S of NC 53	46.4	
202	SR1325	Sill's Creek Branch	0.4 Mi W of SR 1324	47.4	

* Included in current Transportation Improvement Program.

There were no bridges that received a rating of 50 % or less in the category termed functionally obsolete in Pender County.

5. POPULATION, LAND USE, AND TRAFFIC

Burgaw is located approximately 1.6 km (1 mile) west of I-40, at the intersection of US 117 and NC 53. Burgaw is located along a busy section of highway, as trucks make their way from I-40 to US 421 by way of NC 53.

Factors Affecting Transportation

Population, land use and traffic are the three major factors in determining the transportation needs of an area. In addition, travel type and frequency are also studied. The Thoroughfare planning process incorporates all these variables into a plan that best meets the needs of the area.

In order to make predictions of these variables, several factors must be examined. Historic and potential population changes, significant trends in the economy, character and intensity of land development, nature of travel, and motor vehicle registration were all analyzed for this study. In addition, factors that affect development such as zoning, availability of public utilities and transportation, and the physical characteristics of the land were also studied.

Population Trends

Since the volume of traffic on a section of roadway is related to the size and distribution of population that it serves, population data is one of the tools used to determine the needs of the system.

In 1985 the population of Pender County was 24394. Current figures show a population of 32528, an average annual increase of 3.25 %. The Town of Burgaw showed a larger increase. In 1985, the population was 1829. This number grew to 2718 by 1993; an average annual increase of 5 %. Over that same period of time, the Statewide population grew 1.3 %. The State population is expected to grow to around 8.8 million by 2020. Burgaw is currently growing at a fairly healthy rate. This trend is expected to continue through the planning period, with the population growing to around 6,000 by the year 2020.

TABLE 5-1

YEAR	BURGAW POP.	PENDER CO POP.	NORTH CAROLINA POP.
1985	1829	24394	6,254,998
1986	1887	25201	6,323,174
1987	1984	26231	6,405,868
1988	2006	27014	6,483,344
1989	2079	27988	6,568,810
1990	2099	28855	6,632,448
1991	2161	30110	6,751,713
1992	2194	30976	6,838,230
1993	2178	32546	6,952,424
1994	3427	33588	7,064,470
2020	6000	50700	8,800,000 *

* Projected population.

Land Use

Land use refers to the physical patterns of activities and functions within a town. Nearly all traffic problems in a specific area are relative to the area's land use. The amount of traffic on a particular street is very closely related to its adjacent land use. For example, a large industrial plant might be the cause of congestion during shift change hours as its workers come and go. However, during the remainder of the day, little, if any, problems might occur. The spatial distribution of different types of land use (sometimes referred to as traffic generators) is the predominant determinant of when, where, and why congestion occurs. The attraction between different land uses and their association with travel varies depending on the size, type, intensity, and spatial separation of each land use.

For Transportation Planning, land use is grouped into the following categories:

Residential- all land devoted to the housing of people with the exception of hotels and motels;

Commercial- all land devoted to retail trade including consumer and business services and their offices;

Industrial- all land devoted to manufacturing, storage, warehousing, and transportation of products;

Public- all land devoted to social, religious, educational, cultural, and political activities.

Outside the city limits of Burgaw, the land is sparsely developed. Nearly all is residential, with some industrial areas. Inside the city, all types of land uses may be found. Burgaw has a concentration of commercial development in the center of Town. Being the county seat for Pender County, Burgaw also has several government buildings, State Maintenance areas, and a prison. There are also areas of industrial as well as residential development. Along major routes in the area, specifically US 117 and NC 53, commercial and industrial development has occurred in the past few years (see **figure 5-A**).

Barriers to future development in the Burgaw area include wetland areas (see **figure 6-B)** and flood zones. Also, the availability of water and sewer service will determine the direction of growth in this area. The construction of the Thoroughfare Plan will also affect development. The frontage road, when built, will provide an attractive location for industrial development. The NC 53 bypass area will be of interest to both residential and commercial developers. The urban loop could also initiate development by providing access to this area. Development is also expected to continue along NC 53 and US 117 Bypass.

Vehicle Registration

On the average, growth in vehicle registration tends to mirror growth in ADT. Vehicle registration has grown at an average annual rate of 5.4 % since 1985, more than twice the North Carolina average of 2.5 %.

TABLE 5-2

VEHICLE REGISTRATION

YEAR	PENDER CO	NORTH CAROLINA
1985	16117	4,232,910
1986	17660	4,558,173
1987	18539	4,618,412
1988	19516	4,735,473
1989	20564	4,861,859
1990	21333	4,919,592
1991	21987	4,960,768
1992	23179	5,093,786
1993	24798	5,264,350
1994	26020	5,449,792

Travel Demand

Travel demand is usually measured by portable traffic counters and recorded in average daily traffic. This information is collected at several locations in the county. The traffic counts at each location are compared with past counts to determine a trend. For this study, the trend over the last 10 years was studied.

After analyzing population, vehicle registration, and average daily traffic (ADT) trends, growth rates were chosen for the area. A rate of 2.0 % per year was chosen determine the future travel demand for the town. This rate was used for all of Burgaw, except NC 53. A rate of 2.5 % per year was used on NC 53.

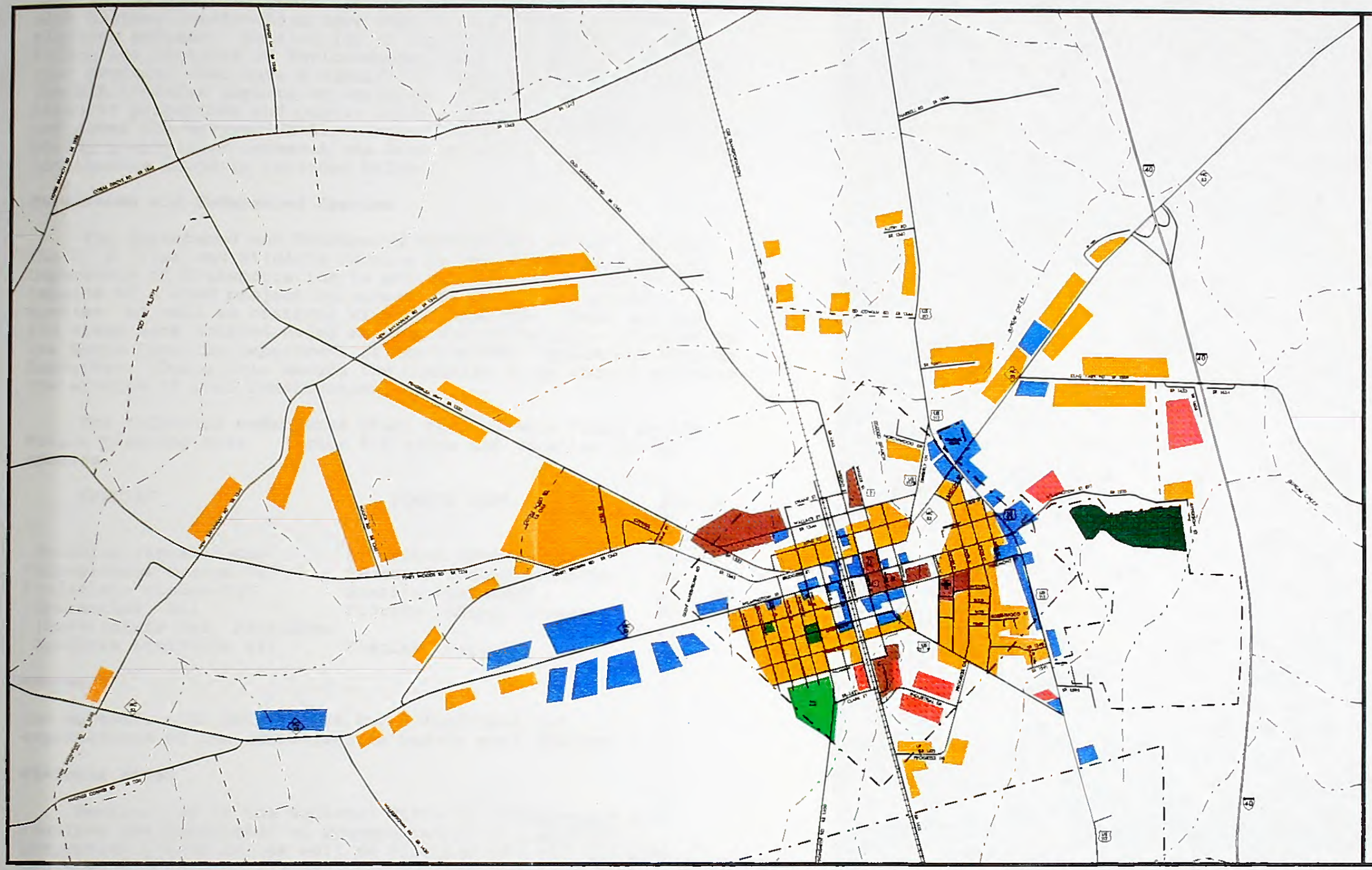

FIGURE 5-A

EXISTING LAND USE

LEGEND

- *RESIDENTIAL*
- *RECREATIONAL*
- *INDUSTRIAL*
- *COMMERCIAL*
- *GOV., INSTITUTIONAL*
- *VACANT, AG, FOREST*

N

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6. ENVIRONMENTAL CONCERNS

In the past few years, environmental concerns associated with highway construction have come to the forefront of the planning process. Section 102 of the National Environmental Policy Act requires an Environmental Impact Statement (EIS) for road projects that have a significant impact on the environment. The EIS includes impacts on wetlands, wildlife, water quality, historic properties and public lands. While this report does not cover the environmental concerns in as much detail as an EIS would, preliminary research was done on several factors and the information found is included below.

Threatened and Endangered Species

The Threatened and Endangered Species Act of 1973 allows the U. S. Fish and Wildlife Service to impose measures on the Department of Transportation to mitigate the environmental impacts of a road project on endangered animal and plant species, as well as critical wildlife habitats. These species and areas were located using mapping and information provided by the North Carolina Department of Environment, Health and Natural Resources. Doing this during the planning stage should minimize the effects of road construction.

The following endangered plant species were found in the Burgaw planning area. Figure **6-A** gives the location of the species.

	SPECIES	COMMON NAME	STATUS NC	STATUS US
1.	Helenium Pinnatifidum	Dissected Sneezeweed	SR	-
2.	*Arnoglossum Ovatum 003	Savannah Indian-plantian	SR	-
3.	*Tofieldia Glabra 025	Granite Flatsedge	C	C2
4.	Spiranthes 001 (Brevilabris var. Floridana)	Florida Ladies'-tresses	SR	-
5.	Agalinis Linifolia 031	Flaxleaf Gerardia	SR	-

* Destroyed

See appendix C of this report for definitions and explanations of the abbreviations beside each species.

Historic Sites

Section 106 of the National Historic Preservation Act requires the Department of Transportation to identify properties listed in, as well as eligible for, the National Register of Historic Places. The DOT must consider the impact of its road projects on these properties and consult with the Federal Advisory Council on Historic Preservation.

NC General Statute 121-12(a) requires the DOT to identify historic properties listed on the National Register, but not necessarily those eligible to be listed. The DOT must consider impacts and consult with the North Carolina Historical Commission, but is not bound by their recommendations.

Only two properties on the National Register exist in the Burgaw planning area. The recommendations made in the Burgaw Thoroughfare Plan should have no affect on these properties.

1. Burgaw Depot
   102 E. Fremont St.
   NRHP # 1203

2. Pender County Courthouse
   Courthouse Square
   NRHP # 1468

Archaeological Sites

Several sites of archaeological significance exist in the planning area. Whenever possible, these areas of archaeological significance were avoided.

Wetlands

Wetland areas were located using the Wetlands Inventory Mapping, provided by the U. S. Fish and Wildlife Service (see **figure 6-B**). These areas were located so the effects to these natural resources could be minimized.

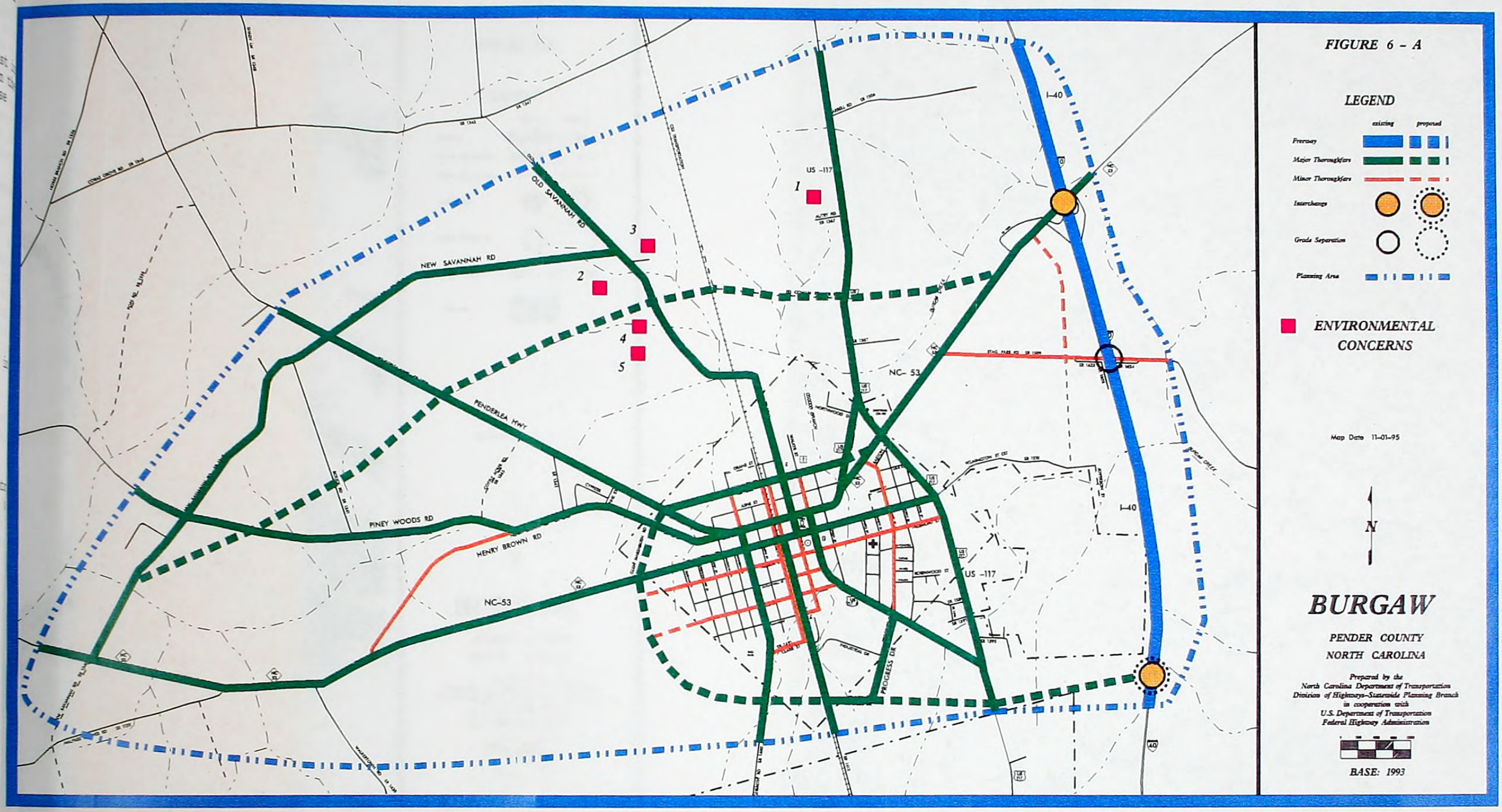
FIGURE 6 - A
LEGEND
existing
proposed
Freeway
Major Thoroughfare
Minor Thoroughfare
Interchange
Grade Separation
Planning Area
ENVIRONMENTAL CONCERNS
Map Date 11-01-95
N
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PENDER COUNTY
NORTH CAROLINA
Prepared by the
North Carolina Department of Transportation
Division of Highways-Statewide Planning Branch
in cooperation with
U.S. Department of Transportation
Federal Highway Administration
BASE: 1993
I-40
US -117
NC- 53
NEW SAVANNAH RD
OLD SAVANNAH RD
PENDERLEA HWY
FINEY WOODS RD
HENRY BROWN RD
PROGRESS DR
1
2
3
4
5

FIGURE 6-B

LEGEND

	existing	proposed
Freeway		
Major Thoroughfare		
Minor Thoroughfare		
Interchange		
Grade Separation		
Planning Area		
Wetlands		

Map Date 11-01-95

N

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7. PUBLIC INVOLVEMENT AND ALTERNATE PROPOSALS

The original draft of the thoroughfare plan was presented to the Planning Board at their regular monthly meeting, May 11, 1995. This plan is shown in figure **7-A**.

Concern was expressed in using McNeil Street as part of the loop due to its scenic and quiet nature. To remedy this, it was suggested to use US 117 as the eastern section of the loop. The Board also requested a frontage road connecting Stag Park Road (SR 1509) with NC 53 to allow access from the industrial area to I-40 (see figure **7-B**).

The recommendations from the Board were incorporated, and the revised plan was presented to the Board June 8, 1995. The Planning Board requested a connection from US 117 at the loop intersection to I-40. The new interchange would lessen travel time from areas in the southern part of Town to I-40. The Planning Board also suggested that this could ease traffic on US 117. The change was added to the plan, and the Planning Board voted to recommend the plan to the Town Board (see figure **7-C**).

On July 10, 1995, the plan was presented to the Town Board. A small group of citizens voiced their concerns over the location of the NC 53 Bypass. The group asked that alternative routes for the bypass be studied. The Board recommended to have a public workshop to deal with the questions and concerns about the bypass.

The Public Workshop was held August 29, 1995. Nearly all in attendance agreed that a bypass was needed. Their concerns centered around the location of the bypass. At the request of the citizens, and the Town Board, several alternatives were devised and studied (see **figure 7-D** and **table 7-1**).

Alternative C from table 7-1 was chosen because of its minimal number of residential relocations, and relatively low cost. The recommended alignment was presented in a public workshop on October 2, 1995 (see **figure 7-E**). The Board voted to table discussion on the bypass until a future date.

Before this date could be set, the recommended location changed. Due to alignment problems where the bypass would have tied into existing NC 53 West of Town, and large public opposition, route C was dropped in favor of alternative B (**see figure 7-F**).

The new plan was presented in a Public Hearing November 28, 1995. During this hearing, the suggestion was made to tie the western end of the bypass to existing 53 at a "Y" intersection. The main reason was to discourage trucks from cutting across to Malpass Corner Road (SR 1120). The DOT

staff felt this would only encourage trucks to use Horse Branch Road (SR 1336), at the Pender High School, to cut over to Malpass Corner Road (SR 1120). This suggestion was not included in the Thoroughfare Plan.

Another suggestion involved intersecting Penderlea Highway (SR 1332) at a different location (see **figure 7-G**). The crossing was suitable, however the shift added an "S" curve to the Bypass alignment. For this reason the suggestion was not included in the Burgaw Thoroughfare Plan.

A concern was voiced on the effect the bypass would have on the drainage problems of several residents. The area in question is the eastern end of the bypass where it intersects existing NC 53. The citizens were advised to contact their Division Engineer for possible solutions to their drainage problems.

At the conclusion of the Public Hearing, the Board members in attendance voted unanimously to adopt the Burgaw Thoroughfare Plan (see **figure 7-F**).

The public involvement phase in Burgaw was quite extensive. The NC 53 Bypass caused enough of a stir to have DOT Staff meeting with Burgaw for several months. Many of these meetings were reported by the local newspaper. Included in the following pages are copies of the newspaper stories, as well as the bypass alternate routes figures.

NCDOT unveils proposed NC 53 bypass for Burgaw

BURGAW – State transportation planners gave Burgaw planners their first look last Thursday at a proposed route for an NC 53 bypass of the town.

Burgaw town officials have sought the proposed road primarily to get truck traffic, much of it carrying hazardous cargo, off the narrow, twisting route of NC 53 through the heart of the town.

The state transportation planners said they had considered two routes for the bypass.

The recommended route would turn west off the existing route of NC 53 just below Burgaw Creek Loop Road (SR 1508), intersect US 117 at Ed Cowan Road (SR 1346), follow the route of Ed Cowan Road and continue west to a point just below New Savannah Road.

The bypass would then intersect New Savannah Road (SR 1340) slightly west of its intersection with Old Savannah Road, then generally follow the route of New Savannah Road (straightening a couple of curves) back to the existing NC 53 just east of Horse Branch. The route would go past the old county landfill

NCDOT transportation engineer Mark Freeman, who presented the proposed bypass route to the Burgaw Planning Board – said NC 53 east of the downtown was already overloaded with traffic, so there was good justification to consider the bypass.

The state transportation planners said that the project would cost an estimated $8.1 million and require the relocation of ten residences and three businesses.

Noting that the planning and design funds for the bypass have been included in the new proposed Transportation plan beginning in 1998, NCDOT transportation engineer Rick Blackwood advised the Burgaw planners to "lobby to get the project accelerated."

The Burgaw planning panel took no immediate action on the proposed bypass plan, which they were seeing for the first time.

The town planners did direct the NCDOT staff members to make changes in a proposed inner loop route that the state engineers said might be needed to improve traffic flow as the town continued to grow.

By Dora Corbett, Staff Writer

BURGAW – Everyone agrees that Burgaw needs an NC 53 bypass, but no one wants it in his or her front door.

State highway planners who met with about 45 interested citizens in Burgaw last week agreed to come back to the county seat next month with yet another set of route alternatives for the road, which NCDOT says it will build sometime after the year 2000.

Rick Blackwood and Mark Freeman, the two Department of Transportation planners who came to listen to citizen concerns last week, said they were open to ideas from local residents.

"Bring us your plan. We'll study it with a microscope!" promised Freeman.

The bypass route originally proposed for the NC 53 bypass would begin on NC 53 near I-40, utilize Ed Cowan Road and a significant portion of New Savannah Road, and reconnect with existing NC 53 about halfway between Malpass Corner Road and Pender High School.

That route got New Savannah Road residents upset about the traffic that would be diverted to their areas. But proposals from the New Savannah residents for alternate routes have also raised concerns by other residents and property owners who might be impacted by those routes.

Blackwood and Freeman said that, at current rates of growth, there will be twice as much truck and car traffic on NC 53 in downtown Burgaw 15 years from now.

A date for the next public meeting on the bypass has not been announced yet.

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WOULD FORCE FEWER HOMES TO MOVE

Revised route for Burgaw bypass

By HOLLY PRICE
Staff Writer

BURGAW — After hearing objections in July to their first proposal, state transportation officials have a new route for a Burgaw bypass.

But some residents say the new N.C. 53 bypass route is no better than the first.

"I can't see satisfying a few people by not having a road run by their house and turning around and running the road through people's farms," said Buron Lanier, who lives near the proposed bypass route.

The first proposal would have veered off N.C. 53 near Stag Park Road east of Burgaw and re-entered the highway near Pender High School. Several existing roads would have been used, including a long stretch of New Savannah Road. That road's residents disliked the plan, because about 10 houses would have had to be moved.

The new route, which would only affect three homes, would swing closer to Burgaw. East of town, it would veer off N.C. 53 near Stag Park Road much like the first plan, but cut closer to town. It would cross Penderlea Highway west of town and re-enter N.C. 53 just east of Malpass Corner Road. Fewer existing roads would be used, so much of the bypass would have to be constructed.

The proposed road would run through Katie and Richard Thomas' produce farm. They worry that it would ruin their business.

"There's no logic in this thing," Mrs. Thomas said. "We feel like we're being railroaded."

A week ago, state officials presented the plan at a workshop. Monday, they presented the plan to the Burgaw Board of Commissioners to approve. The commissioners decided to delay a decision.

"I don't think we should adopt this today when we have so little information about it," said Commissioner Charles Rooks.

State officials say they've looked at 12 alternatives in the last few months, and the proposed route seems best.

"We wish there was an alternate that would affect no one and everyone would be happy," said Mark Freeman, a state transportation planner. "But we just haven't been able to do that."

He said planners consider many factors in choosing a route, including environmental concerns and the number of people affected.

Construction on the bypass is scheduled to begin in 2003. The

has its critics, too

bypass would route traffic around Burgaw's central business district. Without it, trucks traveling N.C. 53 must make several 90-degree turns to get through Burgaw.

The Town Board will discuss proposed route at its next meet A public hearing will be held be then, but no date has been set, Mayor John James.

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Reprinted with permission from Pender Post.

Latest NC 53 alternative gets unanimous approval

Burgaw board OK's bypass route

By DORA CORBETT

BURGAW – The third time was the charm for NC 53 bypass proposals Tuesday night.

The Burgaw Board of Commissioners approved the last of three different recommendations by the North Carolina Department of Transportation staff for a future NC 53 bypass that would begin just west of I-40, use existing Ed Cowan Road, and connect to New Savannah Road slightly north of its intersection with NC 53 West.

Adoption of the proposed corridor for the road will help state planners and town officials protect the route against future development that might make right-of-way acquisition more difficult.

NCDOT planners Mark Freeman and Rick Blackwood, who spent months trying to devise a route that would minimize public concerns about the road's impact, struck paydirt on the third try.

Earlier alternatives have met with strong objections from residents of New Savannah Road, from farmers, and from citizens concerning about traffic safety.

The latest route, which still has its critics, avoids most existing residences and travels primarily through timber lands or the edges of farms.

The "Plan B" route was unanimously approved by the Burgaw commissioners, although Mayor Junny James was absent because of his mother's illness.

As the road project nears development, additional public hearings will be held on the precise location of the road. Right-of-way acquisition is currently scheduled to begin in about seven years.

Although the latest plan muted opposition from many earlier critics of proposed bypass routes, not everyone was happy.

Farmer Jerome Lanier warned that he is willing to give up a corner of his farmer, but not the whole farm.

Grafton Bradshaw, whose daughter lives near the proposed route, said he could live with the line as drawn – "but if it moves, we'll have to talk."

Other complaints came from Larry Bolick, who wanted the road to go through timber land only, and from Frank Humphrey, who asked that a disinterested party be selected to study the road corridor.

Annie Bannerman, who lives in the Burgaw Creek area near the eastern end of the proposed bypass, expressed concern about its future impact on drainage.

"We're already floating in a ditch and another road will put us deeper in a hole," she said.

"There's enough timber floating near I-40 to build a mansion," said Gladys Fennell, who shared Bannerman's concerns.

Blackwodd said he did not believe the proposed highway would adversely affect drainage, but that he would report the problem to project planners.

The proposed bypass route is also expected to be placed before the Pender County Board of Commissioners for action in December.

Local governments will be expected, through their planning powers, to help protect the corridor and keep development out of its path.

Parts of the route lie in the planning jurisdictions of both the Town of Burgaw and of Pender County.

NC 53 BYPASS ALTERNATIVES

TABLE 7-1

ALTERATIVE	DESCRIPTION	WETLAND MITIGATION (AC)	STREAM CROSSINGS	LENGTH (KM)	RESIDENTIAL RELOCATIONS	COST ($ MILLIONS)
A	FEASIBILITY REC.	1.2	3	10.6	10	8.1
B	RECOMMENDED	1.2	2	8.3	5	8.2
C	WEST NEW LOCATION	1.6	2	7.9	3	7.7
D	EAST NEW LOCATION	1.6	1	7.9	4	7.6
E	W OF FEAS REJECTION	1.2	2	7.1	3	7.1
F	FEAS REJECTION	1.4	2	7.0	5	6.5
G	E SOUTHERN	1.2	2	8.3	14	8.1
H	M SOUTHERN	0.4	0	9.2	14	9.2
I	W SOUTHERN	1.7	0	10.8	14	10.7
J	CORA'S GROVE	4.1	3	14.0	6	12.0

Note: Letters Correspond to Figure 7-D

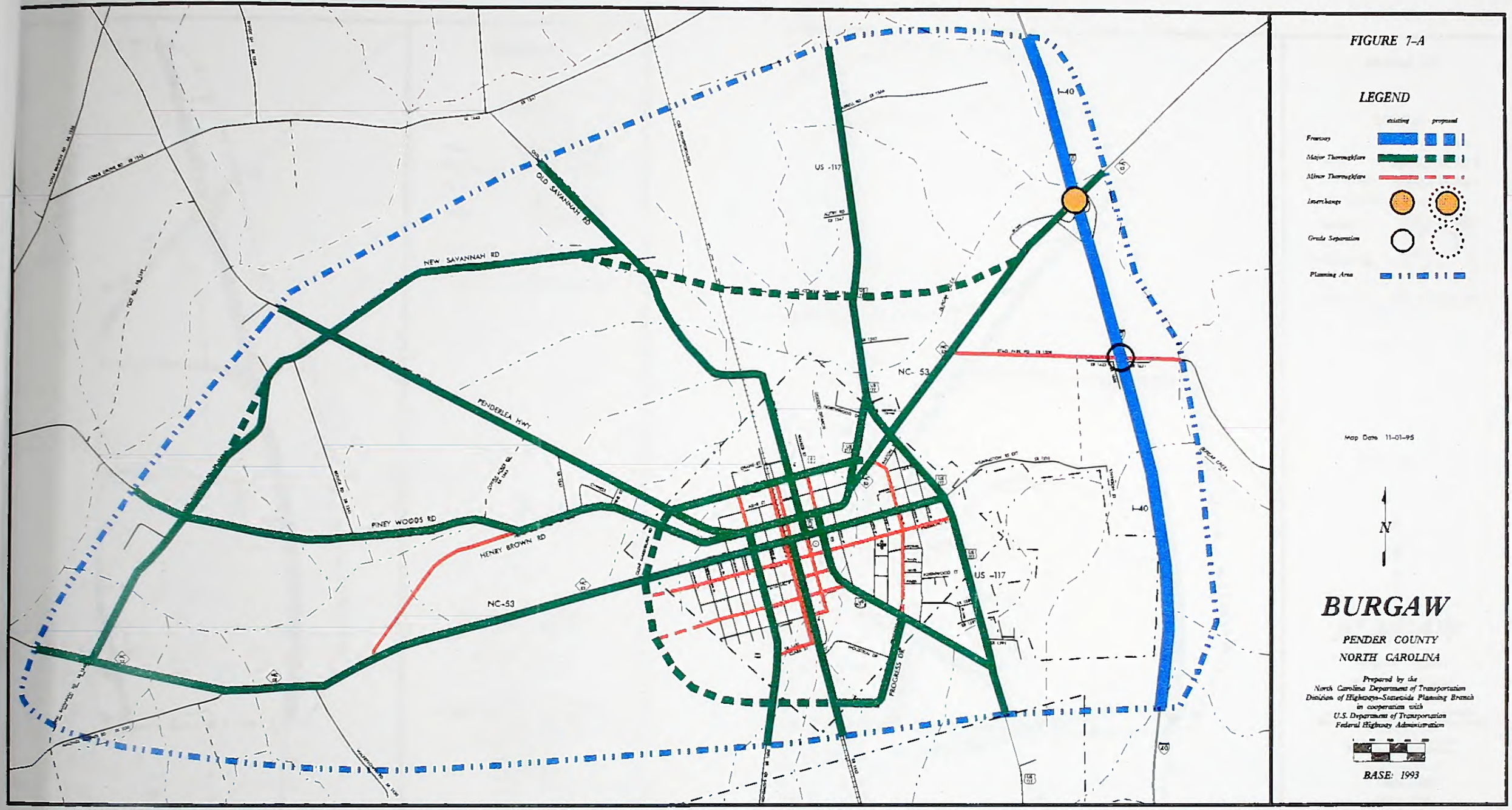

FIGURE 7-A

LEGEND

	existing	proposed
Freeway		
Major Thoroughfare		
Minor Thoroughfare		
Interchange		
Grade Separation		
Planning Area		

Map Date 11-01-95

N

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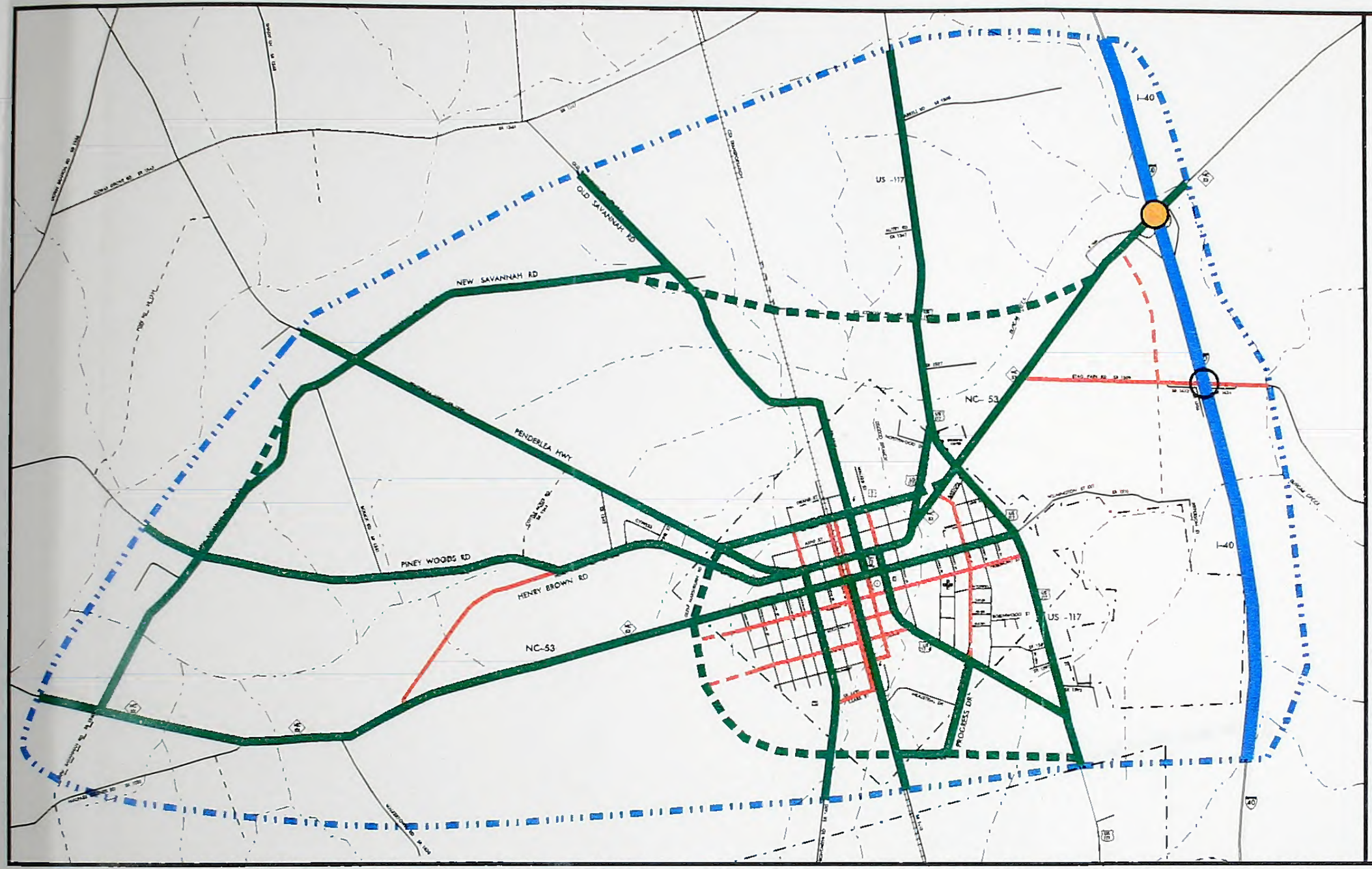

FIGURE 7-B

LEGEND

	existing	proposed
Freeway		
Major Thoroughfare		
Minor Thoroughfare		
Interchange		
Grade Separation		
Planning Area		

Map Date 11-01-95

N

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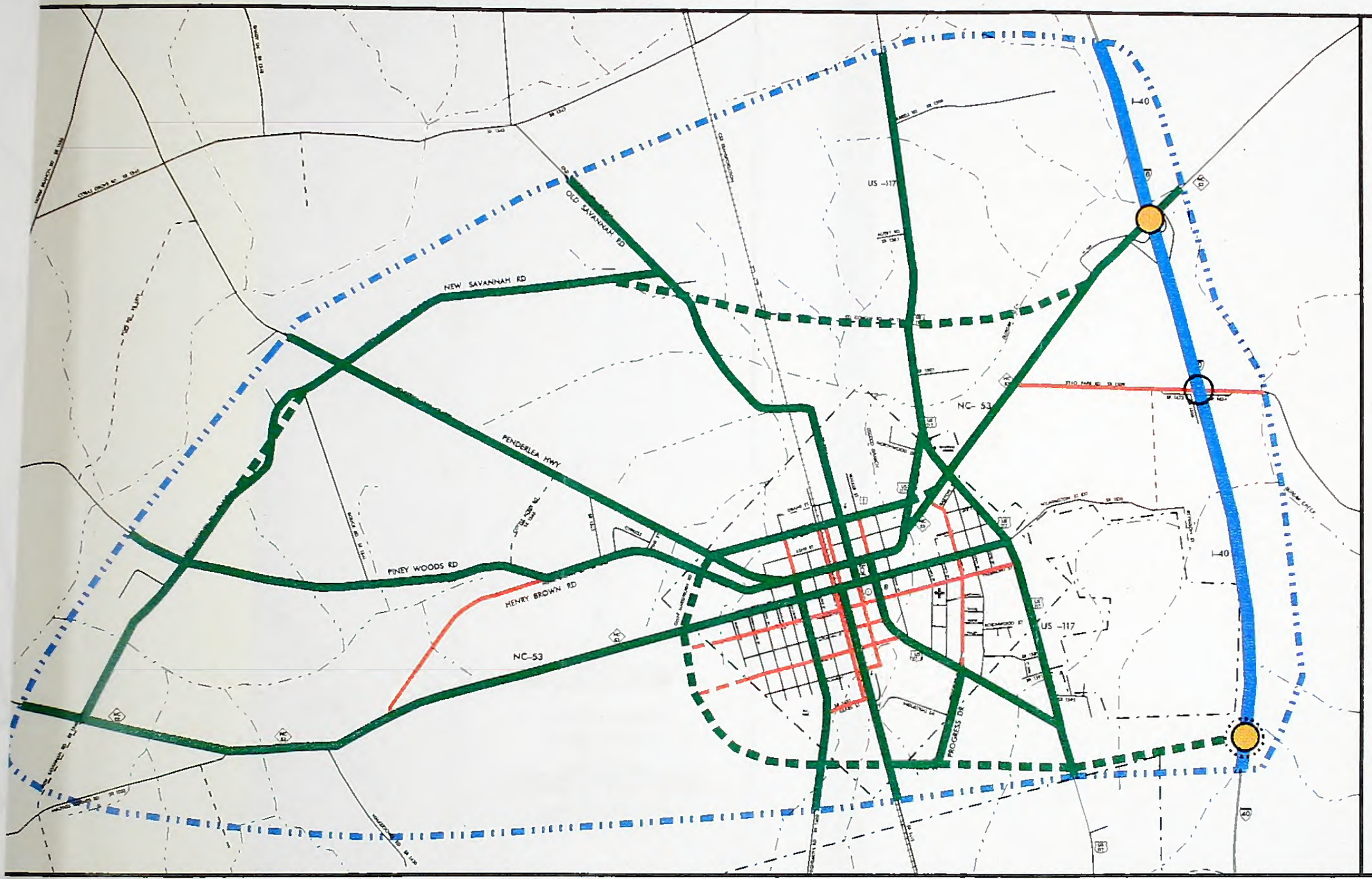

FIGURE 7-C

LEGEND

	existing	proposed
Freeway		
Major Thoroughfare		
Minor Thoroughfare		
Interchange		
Grade Separation		
Planning Area		

Map Date 11-01-95

N

BURGAW

PENDER COUNTY
NORTH CAROLINA

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in cooperation with
U.S. Department of Transportation
Federal Highway Administration

BASE: 1993

FIGURE 7-D

Map Date 11-01-95

N

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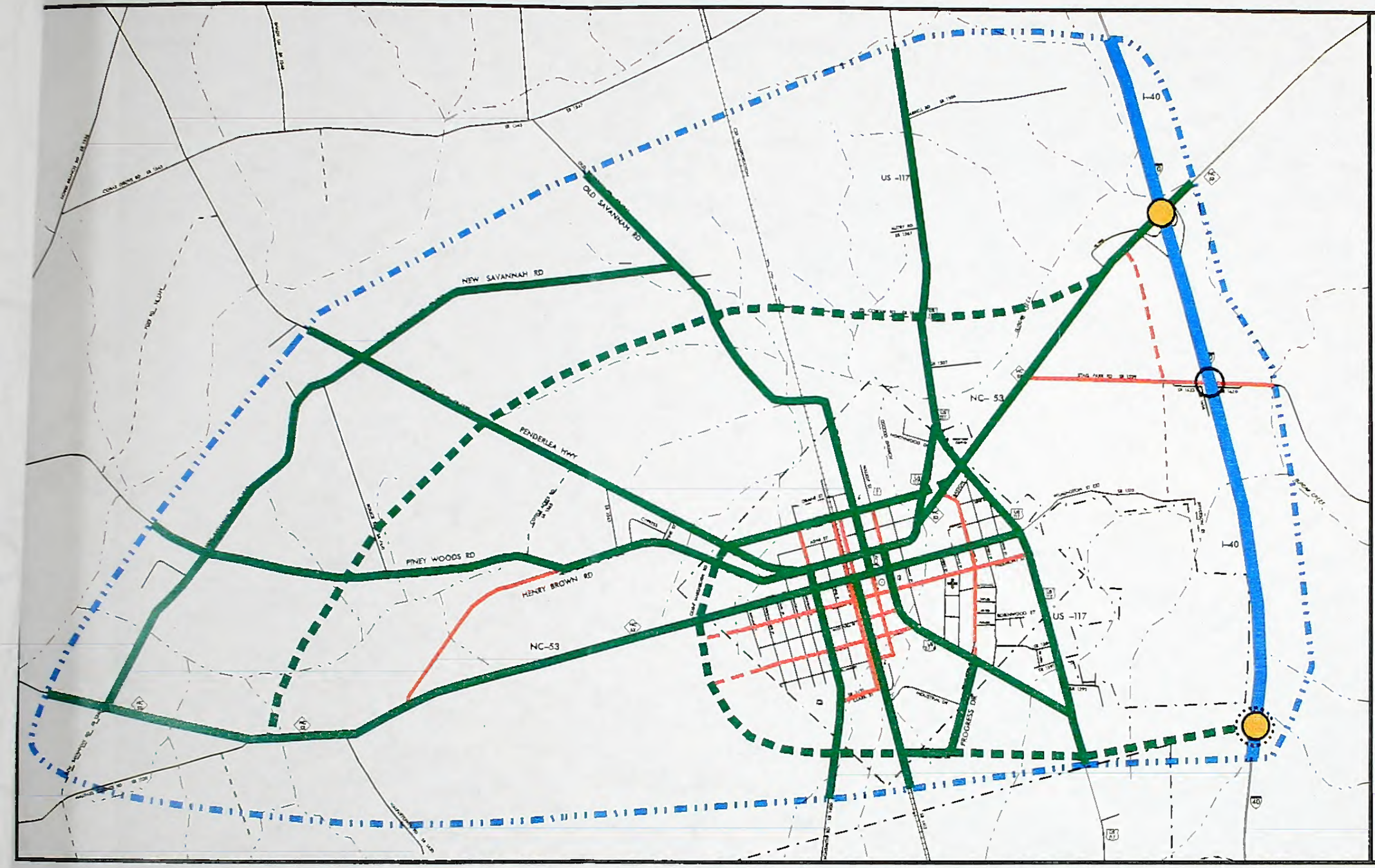

FIGURE 7-E

LEGEND

	existing	proposed
Freeway		
Major Thoroughfare		
Minor Thoroughfare		
Interchange		
Grade Separation		
Planning Area		

Map Date 11-01-95

N

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BASE: 1993

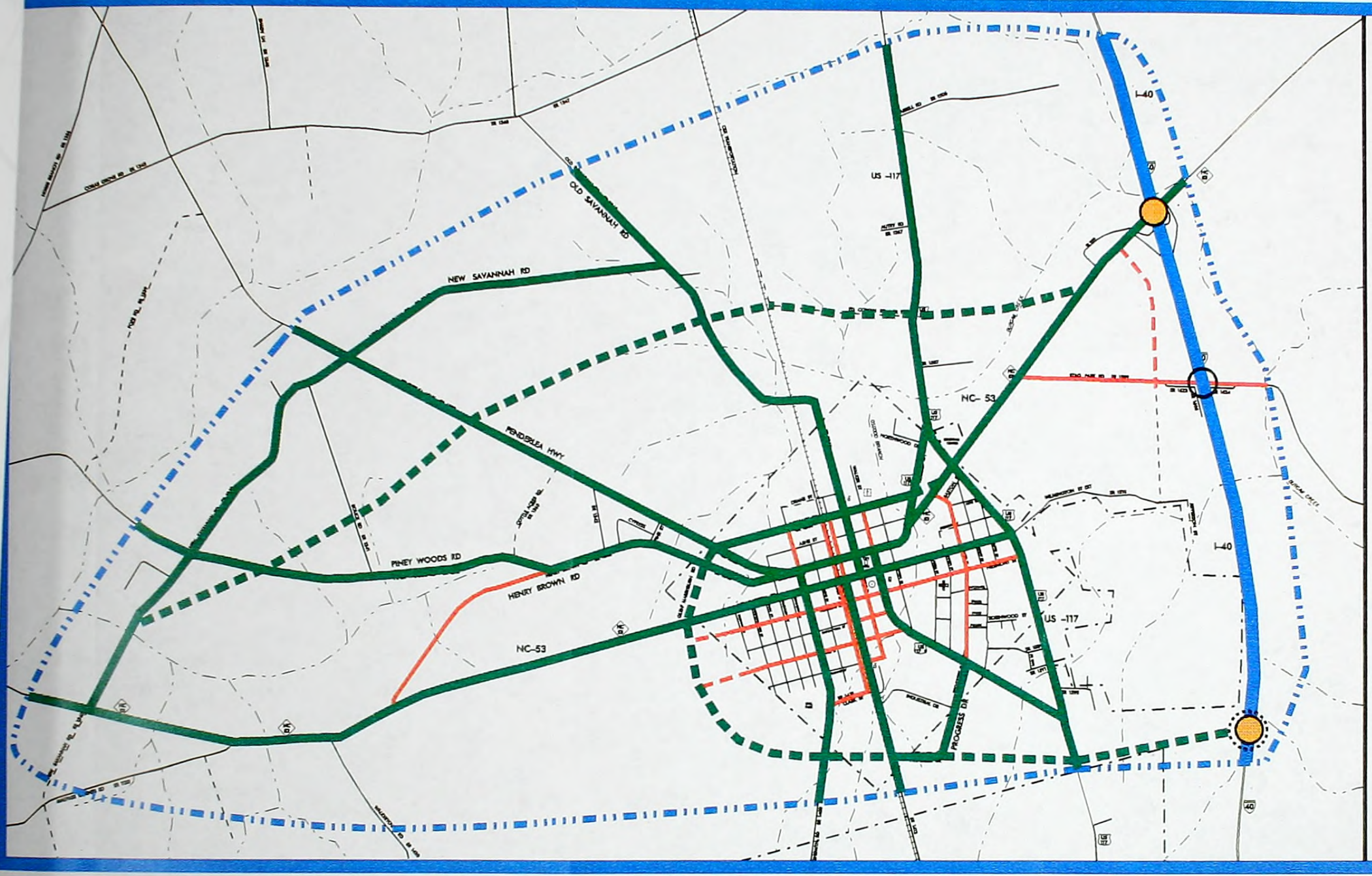

FIGURE 7-F

LEGEND

	existing	proposed
Freeway		
Major Thoroughfare		
Minor Thoroughfare		
Interchange		
Grade Separation		
Planning Area		

Adopted by:

Burgaw	11-28-95
Recommended by Statewide Planning Branch	12-06-95
NC Dept. of Transportation	1-05-96
Public Hearing	11-28-95

Map Date 11-01-95

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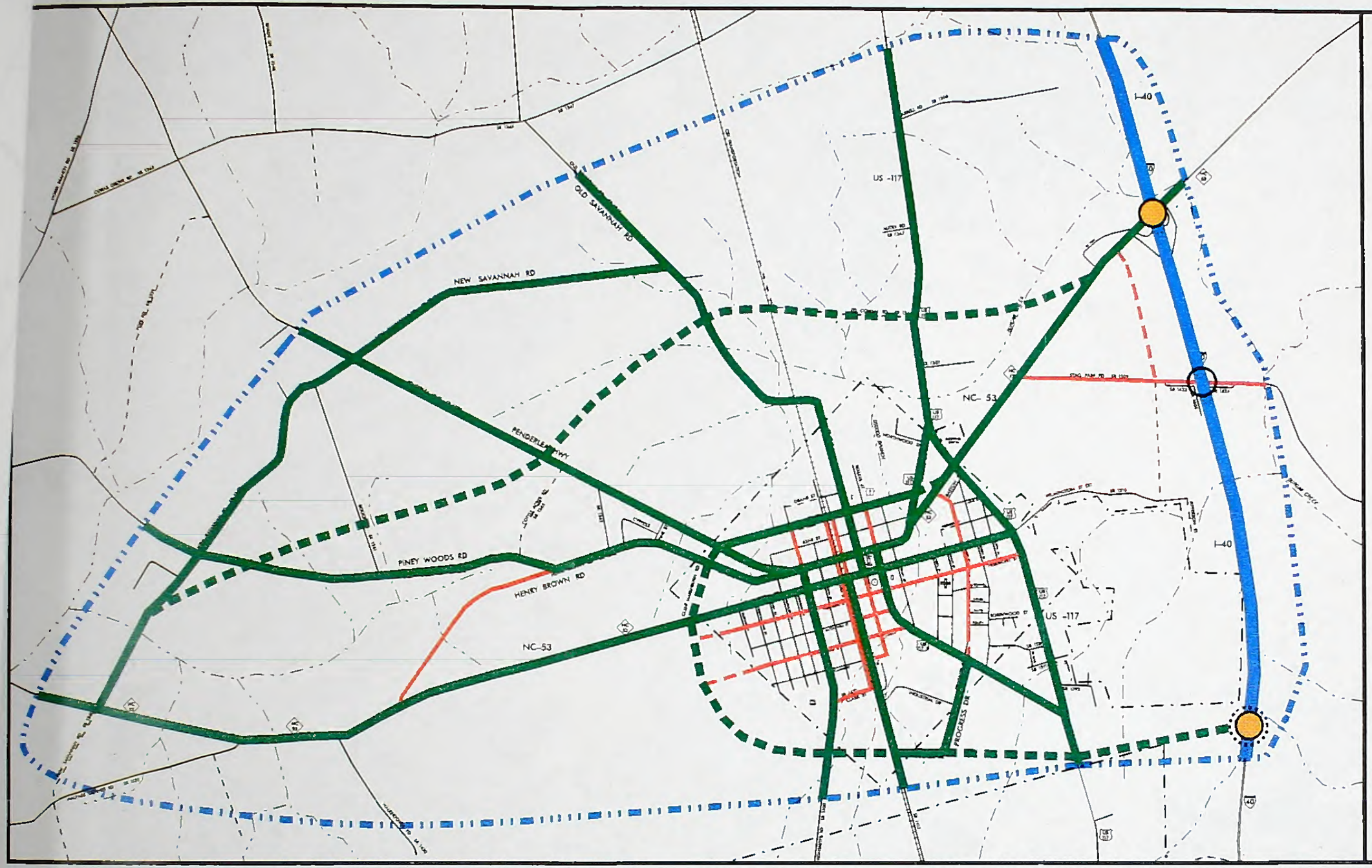

FIGURE 7-G

LEGEND

	existing	proposed
Freeway		
Major Thoroughfare		
Minor Thoroughfare		
Interchange		
Grade Separation		
Planning Area		

Map Date 11-01-95

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8. THOROUGHFARE PLANNING PRINCIPLES

Typically, the urban street system occupies 25 to 30 percent of the total developed land in an urban area. Since the system is permanent and expensive to build and maintain, much care and foresight are needed in its development. Thoroughfare Planning is the process public officials use to assure the development of the most appropriate street system that will meet existing and future travel desires within the urban area.

Objectives of Thoroughfare Planning

The primary aim of a transportation plan is to guide the development of the urban transportation system in a manner consistent with changing traffic demands. Through proper planning for street development, many costly errors and much needless expense can be averted. A transportation plan will enable street improvements to be coordinated with other system improvements as traffic demands increase, and help eliminate unnecessary improvements. By developing the urban street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained that will require a minimum amount of land for street purposes. In addition to providing for traffic needs the thoroughfare plan should embody those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present and future population, commercial, and industrial enterprises, affects major street and highway locations. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

(1) To provide for the orderly development of an adequate major street system as land development occurs;

(2) To reduce travel and transportation costs;

(3) To reduce the cost of major street improvements to the public through the coordination of the street system with private action;

(4) To enable private interests to plan their actions, improvements, and development with full knowledge of public intent;

(5) To minimize disruption and displacement of people and businesses through long range advance planning for major street improvements;

(6) To reduce environmental impacts such as air pollution, resulting from transportation;

(7) To increase travel safety.

Thoroughfare planning objectives are achieved through both: (1) improving the operational efficiency of thoroughfares; and (2) improving the system efficiency through system coordination and layout.

Operational Efficiency

A street's operational efficiency is improved by increasing the capability of the street to carry vehicular traffic and people. In terms of vehicular traffic, a street's capacity is defined as the maximum number of vehicles which can pass a given point on a roadway during a given time period under prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, nature of traffic and weather.

Physical ways to improve vehicular capacity include street widening, intersection improvements, improving vertical and horizontal alignment, and eliminating roadside obstacles. For example, widening of a street from two to four travel lanes more than doubles the capacity of the street by providing additional maneuverability for traffic. Impedances to traffic flow caused by slow moving or turning vehicles and adverse effects of horizontal and vertical alignments are thus reduced.

Operational ways to improve street capacity include:

(1) Control of access - A roadway with complete access control can often carry three times the traffic handled by a non-controlled access street with identical lane width and number.

(2) Parking removal - Increases capacity by providing additional street width for traffic flow and reducing friction to flow caused by parking vehicles and vehicles pulling out from spaces.

(3) One-way operation - The capacity of a street can sometimes be increased 20-50%, depending upon turning movements and overall street width, by initiating one-way traffic operations. One-way streets can also improve traffic flow by decreasing potential traffic conflicts and simplifying traffic signal coordination.

(4) Reversible lanes - Reversible traffic lanes may be used to increase street capacity in situations where heavy directional flows occur during peak periods.

(5) Signal phasing and coordination - Uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.

Altering travel demand is a third way to improve the efficiency of existing streets. Travel demand can be reduced or altered in the following ways:

(1) Encourage people to form carpools and vanpools for journeys to work and other trip purposes. This reduces the number of vehicles on the roadway and raises the people carrying capability of the street system.

(2) Encourage the use of transit and the bicycle mode.

(3) Encourage industries, business, and institutions to stagger work hours or establish variable work hours for employees. This will reduce travel demand in peak periods and spread peak travel over a longer time period.

(4) Plan and encourage land use development or redevelopment in a more travel efficient manner.

(5) Plan and encourage the use of sidewalks to more adequately reflect the communities needs.

System Efficiency

Another means for altering travel demand is the development of a more efficient system of streets that will better serve travel desires. A more efficient system can reduce travel distances, time, and cost. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

Functional Classification

Streets perform two primary functions--traffic service and land service, which when combined, are basically incompatible. The conflict is not serious if both traffic and land service demands are low. However, when traffic volumes are high, conflicts created by uncontrolled and intensely used abutting property lead to intolerable traffic flow friction and congestion. The figure below shows the basic relationship between traffic service and land service. A control of access freeway is an example of a facility that performs only traffic service.

The underlying concept of the thoroughfare plan is that it provides a functional system of streets which permits travel from origins to destinations with directness, ease, and safety. Different streets in the system are designed and called on to perform specific functions, thus minimizing the traffic and land

service conflict. Streets are categorized to function as local access streets, minor thoroughfares, or major thoroughfares (See **Figure 8-A**).

Local Access Streets provide access to abutting property. They are not intended to carry heavy volumes of traffic and should be located such that only traffic with origins and destinations on the streets would be served. Local streets may be further classified as either residential, commercial, and/or industrial depending upon the type of land use which they serve.

Minor Thoroughfares are more important streets in the city system. They collect traffic from local access streets and carry it to the major thoroughfare system. They may in some instances supplement the major thoroughfare system by facilitating minor through traffic movements. A third function which may be performed is that of providing access to abutting property. They should be designed to serve limited areas so that their development as major thoroughfares will be prevented.

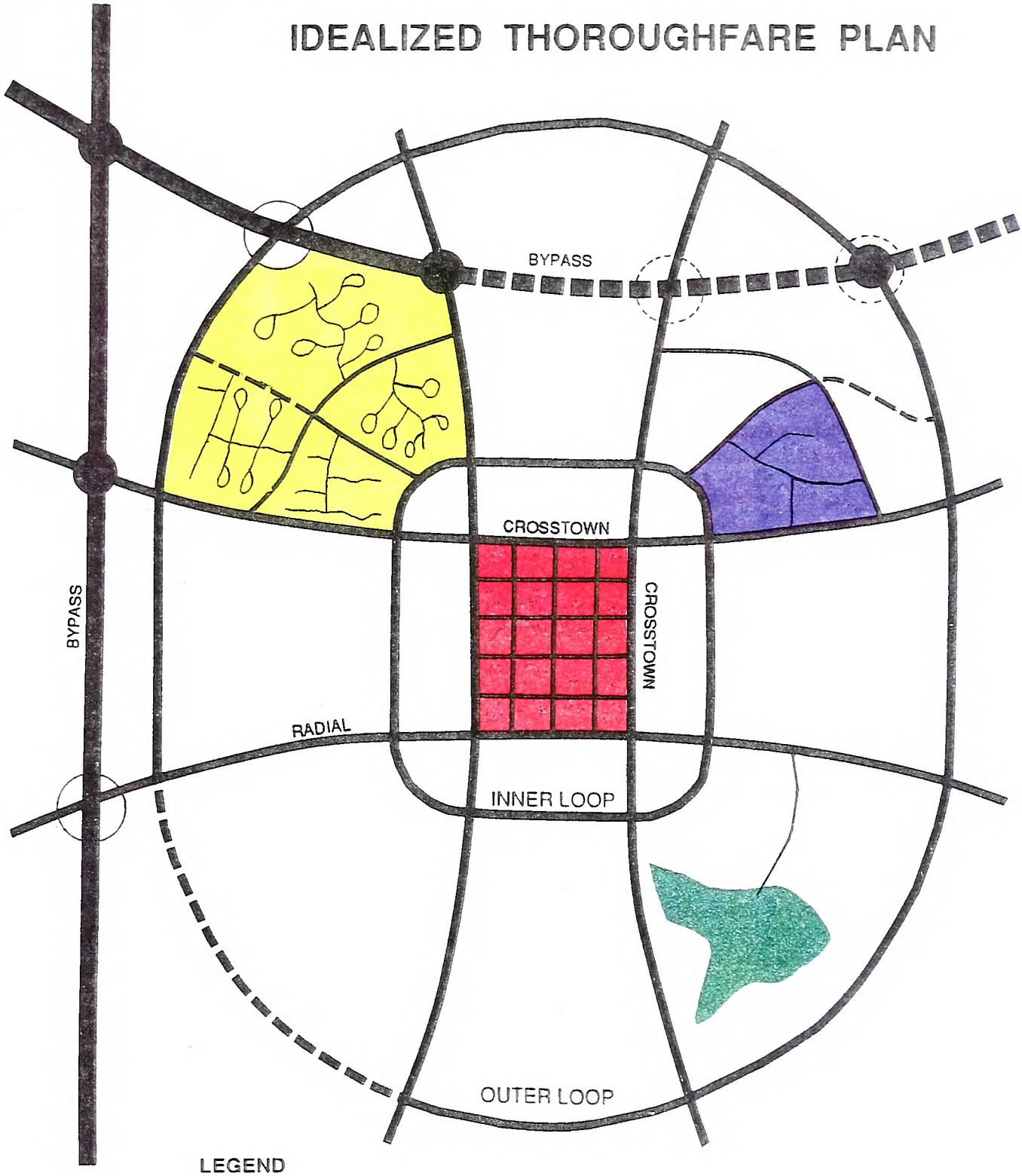
Major Thoroughfares are the primary traffic arteries of the city. Their function is to move intracity and intercity traffic. The streets which comprise the major thoroughfare system may also serve abutting property, however, **their major function is to carry traffic.** They should not be bordered by uncontrolled strip development because such development significantly lowers the capacity of the thoroughfare to carry traffic and each driveway is a danger and an impediment to traffic flow. Major thoroughfares may range from a two-lane street carrying minor traffic volumes to major expressways with four or more traffic lanes. Parking normally should not be permitted on major thoroughfares.

Idealized Major Thoroughfare System

A coordinated system of major thoroughfares forms the basic framework of the urban street system. A major thoroughfare system which is most adaptable to desire lines of travel within an urban area and which permits movement between various areas of the city with maximum directness is the radial-loop system. This system consists of several functional elements-radial streets, cross town streets, loop system streets, and bypasses (**Figure 8-A**). While every city's street system can not conform to the "Idealized Thoroughfare Plan" because of local idiosyncrasies, the concepts are adequate to apply to all areas.

Radial streets provide for traffic movement between points located in the outskirts of the city and the central area. This is a major traffic movement in most cities, and the economic strength of the central business district depends upon the adequacy of this type of thoroughfare.

IDEALIZED THOROUGHFARE PLAN



LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARE FREEWAY		
MAJOR OTHER		
MINOR THOROUGHFARE		
LOCAL ROAD		
INTERCHANGE		
GRADE SEPERATION		

LAND USES

- COMMERCIAL/BUSINESS
- RESIDENTIAL
- INDUSTRIAL
- PUBLIC/INSTITUTIONAL

FIGURE 8-A

If all radial streets crossed in the central area, an intolerable congestion problem would result. To avoid this problem, it is very important to have a system of **cross town streets** which form a loop around the central business district. This system allows traffic moving from origins on one side of the central area to destinations on the other to follow the area's border and allows central area traffic to circle and then enter the area near a given destination. The effect of a good cross town system is to free the central area of cross town traffic, thus permitting the central area to function more adequately in its role as a pedestrian shopping area.

Loop system streets move traffic between suburban areas of the city. Although a loop may completely encircle the city, a typical trip may be from an origin near a radial thoroughfare to a destination near another radial thoroughfare. Loop streets do not necessarily carry heavy volumes of traffic, but they function to help relieve central areas. There may be one or more loops, depending on the size of the urban area, and they are generally spaced one-half mile to one mile apart, depending on the intensity of land use.

A **bypass** is designed to carry traffic through or around the urban area, thus providing relief to the city street system by removing from it traffic which has no desire to be in the city. Bypasses are usually designed to through highway standards, with control of access. Occasionally, a bypass with low traffic volume can be designed to function as a portion of an urban loop. The general effect of bypasses is to expedite the movement of through traffic and to improve traffic conditions within the city. By freeing the local streets for use by shopping and home-to-work traffic, bypasses tend to increase the economic vitality of the local area.

Application of Thoroughfare Planning Principles

The concepts presented in the discussion of operational efficiency, system efficiency, functional classification, and idealized major thoroughfare system are the conceptual tools available to the transportation planner in developing a thoroughfare plan. In actual practice, thoroughfare planning is done for established urban areas and is constrained by existing land use and street patterns, existing public attitudes and goals, and current expectations of future land use. Compromises must be made because of these and the many other factors that affect major street locations.

Throughout the thoroughfare planning process it is necessary from a practical viewpoint that certain basic principles be followed as closely as possible. These principles are as follows:

1. The plan should be derived from a thorough knowledge of today's travel - its component parts, as well as the factors that contribute to it, limit it, and modify it.

2. Traffic demands must be sufficient to warrant the designation and development of each major street. The thoroughfare plan should be designed to accommodate a large portion of all major traffic movements on a relatively few streets.

3. The plan should conform to and provide for the land development plan of the area.

4. Certain considerations must be given to urban development beyond the current planning period. Particularly in outlying or sparsely developed areas which have development potential, it is necessary to designate thoroughfares on a long-range planning basis to protect rights of way for future thoroughfare development.

5. While being consistent with the above principles and realistic in terms of travel trends, the plan must be economically feasible.

APPENDIX A

TYPICAL THOROUGHFARE CROSS SECTIONS

Cross section requirements for thoroughfares vary according to the desired capacity and level of service to be provided. Universal standards in the design of thoroughfares are not practical. Each street section must be individually analyzed and its cross section requirements determined on the basis of amount and type of projected traffic, existing capacity, desired level of service, and available right-of-way.

Typical cross sections are shown in Figure **A-A**. These cross sections are typical for facilities on new location and where right-of-way constraints are not critical. For widening projects and urban projects with limited right-of-way, special cross sections should be developed that meet the needs of the project.

Recommended typical cross sections for thoroughfares were derived on the basis of projected traffic, existing capacities, desirable levels of service, and available right-of-way. The recommended typical cross sections for the thoroughfares are given in Appendix **A** along with other pertinent information.

On all existing and proposed major thoroughfares delineated on the thoroughfare plan, adequate right-of-way should be protected or acquired for the ultimate cross sections. Ultimate desirable cross sections for each of the thoroughfares are listed in Appendix **A**. Recommendations for "ultimate" cross sections are provided for (1) thoroughfares which may require widening after the current planning period; (2) for thoroughfares which are borderline adequate and accelerated traffic growth could render them deficient; and (3) for thoroughfares where an urban curb and gutter cross section may be locally desirable because of urban development or redevelopment.

Recommended design standards relating to maximum and minimum grades, minimum sight distances, maximum degree of curve and related super elevation, and other considerations for thoroughfares are given in Appendix **B**. This Appendix gives definitions and design standards recommended for inclusion in subdivision regulations.

Cross sections "A" and "L" is typical for controlled access freeways. The 14 m (46 ft) grassed median is the minimum desirable median width, but there could be some variation from this depending upon design considerations. Right-of-way requirements would typically vary upward from 70 m (228 ft) depending upon cut and fill requirements.

Cross section "B", seven lane curb and gutter, should not be used for new projects. When the conditions warrant six lanes, cross section "D" should be recommended. Cross section "B" should be used only in special situations such as when widening from a five lane section and right-of-way is limited. Even in these situations, consideration should be given to converting the center turn lane to a median so that cross section "D" is the final cross section.

Cross section "C", five lane curb and gutter, is typical for major thoroughfares where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

Cross sections "D", "E", and "M" are used on major thoroughfares where left turns and intersecting streets are not as frequent. Left turns would be restricted to a few selected intersections. The 4.9 m (16 ft) median is the minimum recommended for an urban boulevard type cross section. In most instances, monolithic construction should be utilized due to greater cost effectiveness, ease and speed of placement, and reduced future maintenance requirements. In special cases, grassed or landscaped medians may be used in urban areas. However, these types of medians result in greatly increased maintenance costs and an increased danger to maintenance personnel. Non-monolithic medians should only be recommended when the above concerns are addressed.

Cross section "F" is recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 7.3 m (24 ft) is recommended with 9.1 m (30 ft) being desirable.

Typical cross section "G" is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left turning movements are light, and right-of-way is restricted. An additional left turn lane would probably be required at major intersections. This cross section should be used only if the above criteria is met. If right-of-way is not restricted, future strip development could take place and the inner lanes could become de facto left turn lanes.

In urban environments, thoroughfares which are proposed to function as one-way traffic carriers would typically require **cross section "H". Cross sections "I" and "J"** are usually recommended for urban minor thoroughfares since these facilities usually serve both land service and traffic service functions. **Cross section "I"** would be used on those minor thoroughfares where parking on both sides is needed as a result of more intense development.

Cross section "K" is used in rural areas or for staged construction of a wider multi-lane cross section. On some thoroughfares, projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time. For areas that are growing and future widening will be necessary, the full right-of-way of 30 m (100 ft) should be required. In some instances, local ordinances may not allow the full 30 m (100 ft). In those cases, 21 m (70 ft) should be preserved with the understanding that the full 30 m (100 ft) will be preserved by use of building setbacks and future street line ordinances.

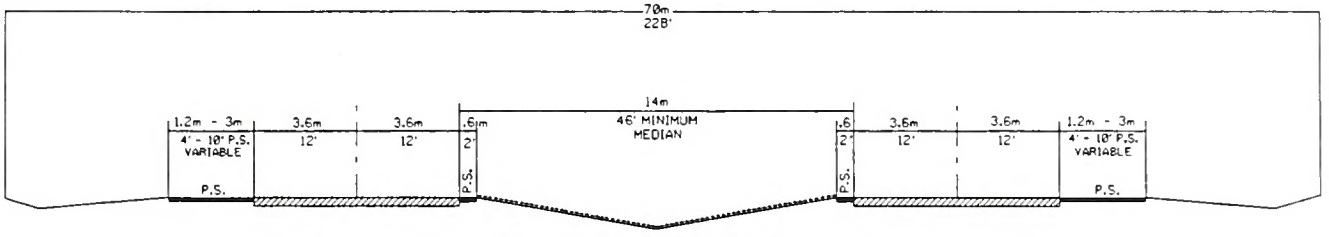
The urban curb and gutter cross sections all illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum right-of-way line. This permits adequate setback for utility poles. If it is desired to move the sidewalk farther away from the street to provide additional separation for pedestrians or for aesthetic reasons, additional right-of-way must be provided to insure adequate setback for utility poles.

The right-of-ways shown for the typical cross sections are the minimum rights-of-way required to contain the street, sidewalks, utilities, and drainage facilities. Cut and fill requirements may require either additional right-of-way or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

If there is sufficient bicycle travel along the thoroughfare to justify a bicycle lane or bikeway, additional right-of-way may be required to contain the bicycle facilities. The North Carolina Bicycle Facilities Planning and Design Guidelines should be consulted for design standards for bicycle facilities. **Cross sections N, O, and P** are typically used to accommodate bicycle travel.

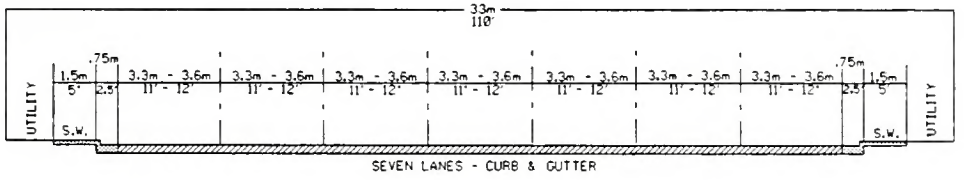
TYPICAL THOROUGHFARE CROSS SECTIONS

A.



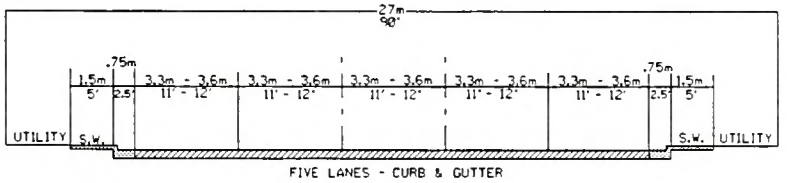
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



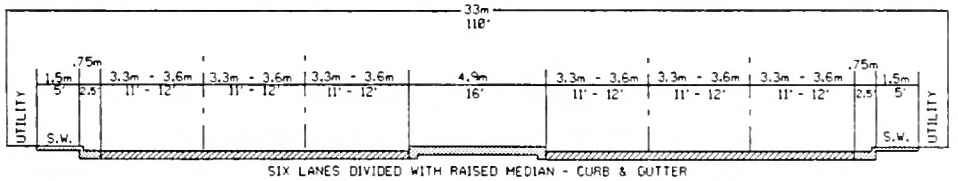
SEVEN LANES - CURB & GUTTER

C.



FIVE LANES - CURB & GUTTER

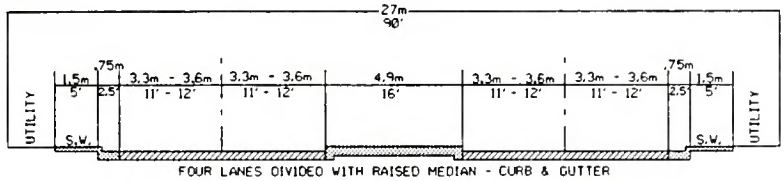
D.



SIX LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

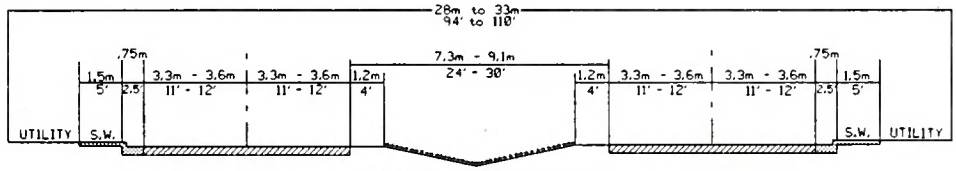
TYPICAL THOROUGHFARE CROSS SECTIONS

E.



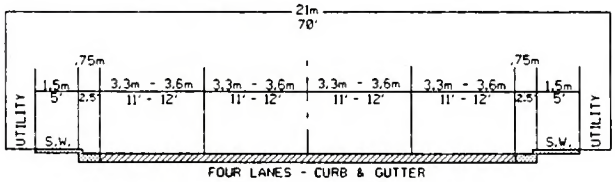
FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

F.



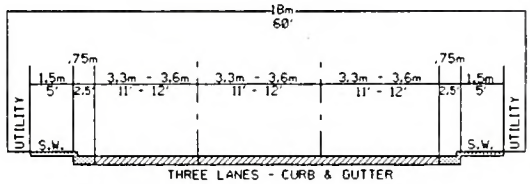
FOUR LANES DIVIDED - BOULEVARD
GRASS MEDIAN

G.



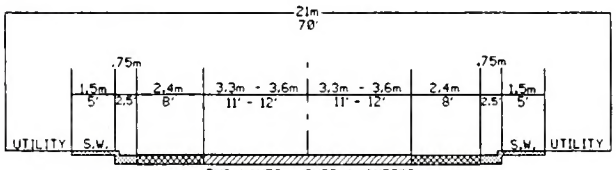
FOUR LANES - CURB & GUTTER

H.



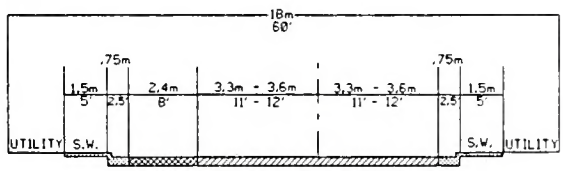
THREE LANES - CURB & GUTTER

I.



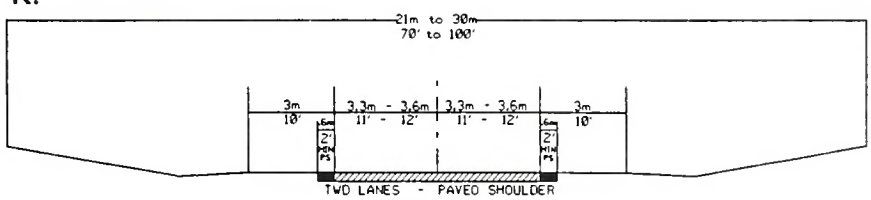
TWO LANES - CURB & GUTTER
PARKING ON EACH SIDE

J.



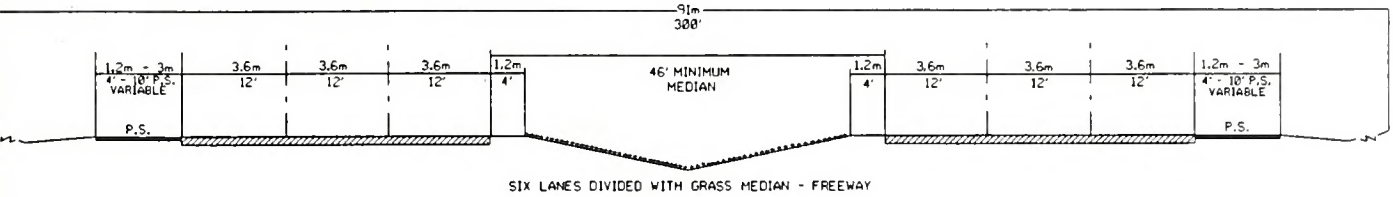
TWO LANES - CURB & GUTTER
PARKING ON ONE SIDE

K.



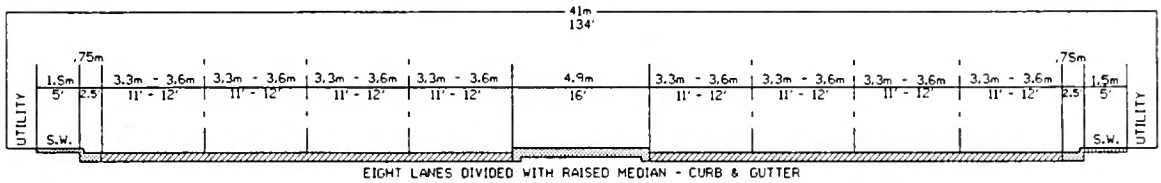
TWO LANES - PAVED SHOULDER

TYPICAL THOROUGHFARE CROSS SECTIONS



SIX LANES DIVIDED WITH GRASS MEDIAN - FREEWAY

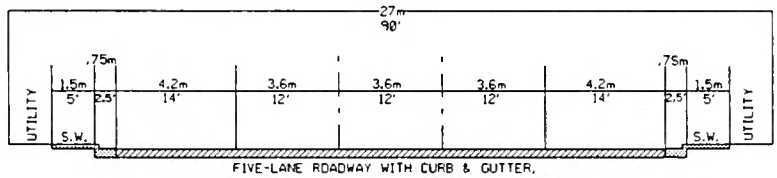
M.



EIGHT LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

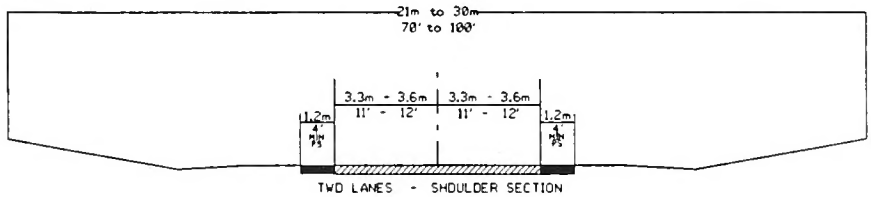
TYPICAL THOROUGHFARE CROSS SECTIONS FOR ACCOMMODATING BICYCLES

N.



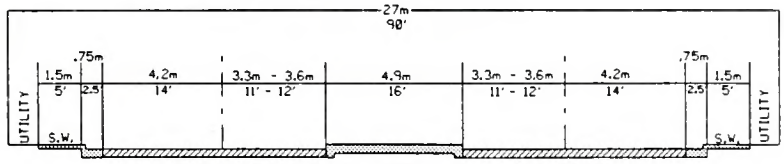
FIVE-LANE ROADWAY WITH CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

O.



TWO LANES - SHOULDER SECTION

P.



FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

TABLE A1
BURGAW
THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS

The Street Tabulation and Recommendations on the following pages consist of a listing of roads in the County, base year and future year traffic volumes, and recommended cross sections for each facility.

Key to abbreviations:

6L	Six lanes
A through P	Refer to thoroughfare cross sections, Figure A-1
ADQ	Adequate existing situation
ADT	Average Daily Traffic, measured in vehicles per day
BRG	Bridge
CAPACITY	Volume of traffic a roadway can handle at Level of Service D
CODE	Refer to thoroughfare cross sections, Figure A-1
DIST	Distance along section of roadway, measured in meters
E, N, S, W	East, north, south, or west
ECL, NCL, SCL, WCL	Eastern, northern, southern, or western city limits
FT	Feet
KM	Kilometers (1 KM = .62 Mile)
MI	Miles
N/A	Not available
PB	Thoroughfare planning boundary
RDWY	Roadway width, measured in feet
ROW	Right-of-way width, measured in feet
RR XING	Railroad crossing
SR	Secondary road number - See Appendix B for list of associated street names
UN	Unpaved roadway
VPD	Vehicles per day

THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS

FACILITY AND SECTION	EXISTING CROSS-SECTION METRIC DIST KM	RDWY M	ROW M	ENGLISH DIST MI	RDWY (FT)	ROW (FT)	PRACTICAL CAPACITY CURRENT (FUTURE)	1993 ADT	2020 (VPD)	RECOMMENDED X-SECTION METRIC (m) RDWY (ULT)	ROW (ULT)	ENGLISH (ft) RDWY (UTL)	ROW (ULT)
I-40	6.0	14.4	96	3.7	48	320	50000	13800	36000	ADQ	ADQ	ADQ	ADQ
US 117 BYP	2.7	10.8	45	1.7	36	150	18000	5900	8800	ADQ	ADQ	ADQ	ADQ
US 117 BUS													
117BYP-FREEMONT	1.8	7.2	45	1.1	24	150	10500	1800	2700	ADQ	ADQ	ADQ	ADQ
FREE-BRIDGERS	0.3	11.4	45	0.2	38	150	18000	2700	4000	ADQ	ADQ	ADQ	ADQ
BRID-WALLACE	0.3	5.4	45	0.2	18	150	(9500)	5400	8100	6.6	ADQ	22.0	ADQ
US 117													
US 117 BUS-NPL	3.2	7.2	45	2.0	24	150	10500	3200	4800	ADQ	ADQ	ADQ	ADQ
NC 53 BYPASS	8.3	--	--	5.1	--	--	(10500)	N/A	6700	K	31.0	K	100.0
NC 53													
I-40 -.1 MI E OF STAG PARK RD	1.6	7.2	18	1.0	24	60	(30000)	6500	13000	C	31.0	C	100.0
.1 MI E OF STAG PARK-.1 MI W OF STAG PARK	0.3	10.8	18	0.2	36	60	18000	6500	9700	ADQ	ADQ	ADQ	ADQ
.1 MI W STAG PARK-.2 MI E OF US 117	0.5	10.8	18	0.3	36	60	18000	6500	9700	ADQ	ADQ	ADQ	ADQ
.2 MI E OF US 117-.2 MI W OF 117	0.6	7.2	18	0.4	24	60	10500	5700	8500	ADQ	ADQ	ADQ	ADQ
.2 MI W OF US 117-US 117 BUS	0.5	6.6	18	0.3	22	60	(10500)	6000	8500	K	ADQ	K	ADQ
NC 53/US117	0.5	6.6	18	0.3	22	60	(10500)	6000	9000	K	ADQ	K	ADQ
WILMINGTON/NC53-SMITH	0.6	13.2	18	0.4	44	60	24000	7100	10600	ADQ	ADQ	ADQ	ADQ
SMITH-GILES MASHBURN	1.0	6.6	18	0.6	22	60	(18000)	6900	10300	H	ADQ	H	ADQ
GILES MASHBURN-SR 1343	2.4	6.6	18	1.5	22	60	9500	4300	8400	ADQ	ADQ	ADQ	ADQ
SR 1343-WPL	0.2	6.6	30	0.1	22	100	9500	3700	7200	ADQ	ADQ	ADQ	ADQ
BRIDGERS ST (SR 1551)	0.6	6.0	N/A	0.4	20	N/A	8000	600	900	ADQ	18.0	ADQ	60.0
CLARK ST (SR 1431)	0.3	5.4	N/A	0.2	18	N/A	(8000)	400	600	6.0	18.0	20.0	60.0

THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS

FACILITY AND SECTION	EXISTING CROSS-SECTION METRIC DIST KM	RDWY M	ROW M	ENGLISH DIST MI	RDWY (FT)	ROW (FT)	PRACTICA CAPACITY CURRENT (FUTURE)	1993 ADT	2020 (VPD)	RECOMMENDED X-SECTION METRIC RDWY (ULT)	(m) ROW (ULT)	ENGLISH RDWY (UTL)	(ft) ROW (ULT)
DICKERSON ST (SR 1412)													
SPL-PROGRESS	0.3	6.6	N/A	0.2	22	N/A	9500	1000	1500	ADQ	18.0	ADQ	60.0
PROG- SATCHWELL	1.1	6.6	N/A	0.7	22	N/A	9500	1700	2500	ADQ	18.0	ADQ	60.0
SATC-BRIDGERS	0.5	9.6	N/A	0.3	32	N/A	12000	700	1000	ADQ	18.0	ADQ	60.0
BRID-WALLACE	0.3	5.4	N/A	0.2	18	N/A	(8000)	700	1000	6.0	18.0	20.0	ADQ
DUDLEY ST	1.4	5.4	N/A	0.9	18	N/A	(8000)	1000	1500	6.0	18.0	20.0	60.0
FREEMONT ST													
117-MCNEIL	0.5	5.4	N/A	0.3	18	N/A	(8000)	3400	5000	6.0	18.0	20.0	60.0
MCNEIL-COWAN	0.5	7.2	N/A	0.3	24	N/A	10500	5480	8200	ADQ	18.0	ADQ	60.0
COWAN-SMITH	0.8	16.2	N/A	0.5	54	N/A	24000	7100	10200	ADQ	18.0	ADQ	60.0
SMITH-DURHAM	0.6	5.4	N/A	0.4	18	N/A	(10500)	7100	9500	K	18.0	K	60.0
FRONTAGE RD	1.0	--	--	0.6	--	--	(10500)	N/A	3000	K	18.0	K	60.0
HAYES RD (SR 1208)													
WALKER-DUDLEY	0.5	5.4	N/A	0.3	18	N/A	(8000)	2700	4000	6.0	18.0	20.0	60.0
DUDLEY-MCCULLEN	0.5	9.9	N/A	0.3	33	N/A	12000	4100	6000	ADQ	18.0	ADQ	60.0
MC-BODENHAMMER	0.2	5.4	N/A	0.1	18	N/A	(8000)	2700	4000	6.0	18.0	20.0	60.0
HENRY BROWN RD (SR 1343)	3.9	6.0	18	2.4	20	60	8000	600	900	ADQ	ADQ	ADQ	ADQ
HIGHSMITH RD (SR 1400)													
SPL-BRIDGERS	2.1	7.2	18	1.3	24	60	10500	1700	2500	ADQ	ADQ	ADQ	ADQ
BRID-WALLACE	0.3	6.0	21	0.2	20	70	8000	350	500	ADQ	ADQ	ADQ	ADQ
I-40 CONNECTOR	1.3	--	--	0.8	--	--	(10500)	N/A	5000	K	18.0	K	60.0
MCNEIL ST													
117BUS-FREEMONT	0.6	5.4	N/A	0.4	18	N/A	(8000)	2000	3000	6.0	18.0	20.0	60.0
FREEMONT-ASHE	0.5	10.8	N/A	0.3	36	N/A	18000	2000	3000	ADQ	18.0	ADQ	60.0
ASHE-NC53	0.2	5.4	N/A	0.1	18	N/A	(8000)	2000	3000	6.0	18.0	20.0	60.0

THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS

FACILITY AND SECTION	EXISTING CROSS-SECTION METRIC DIST KM	RDWY M	ROW M	ENGLISH DIST MI	RDWY (FT)	ROW (FT)	PRACTICAL CAPACITY CURRENT (FUTURE)	1993 ADT	2020 (VPD)	RECOMMENDED X-SECTION METRIC RDWY (ULT)	(m) ROW (ULT)	ENGLISH RDWY (UTL)	(ft) ROW (ULT)
NEW SAVANNAH RD (SR 1340)	4.2	5.7	18	2.6	19	60	8000	200	300	ADQ	ADQ	ADQ	ADQ
OLD SAVANNAH RD (SR 1345A)													
WPL- DAVIE	3.7	5.4	18	2.3	18	60	(8000)	1400	2100	6.0	ADQ	20.0	ADQ
PENDERLEA HWY (SR 1332)	4.3	6.0	18	2.7	20	60	(9500)	3100	4600	6.6	ADQ	22.0	ADQ
PINEY WOODS RD (SR 1216)	1.9	6.0	18	1.2	20	60	8000	800	1200	ADQ	ADQ	ADQ	ADQ
PROGRESS DR	1.1	6.6	18	0.7	22	60	9500	140	200	ADQ	ADQ	ADQ	ADQ
STAG PARK RD (SR 1509)													
NC 53 - 0.8 km E OF NC 53	0.8	6.6	18	0.5	22	60	9500	1300	1900	ADQ	ADQ	ADQ	ADQ
0.8 km E OF NC 53 - I-40	1.0	6.6	84	0.6	22	280	9500	1300	1900	ADQ	ADQ	ADQ	ADQ
I-40 - EPL	0.2	6.6	30	0.1	22	100	9500	1300	1900	ADQ	ADQ	ADQ	ADQ
URBAN LOOP													
WALLACE - NC 53 BUS	0.2	--	--	0.1	--	--	(10500)	N/A	2500	K	18.0	K	60.0
US 117 - PROGRESS	1.0	--	--	0.6	--	--	(10500)	N/A	2000	K	18.0	K	60.0
PROGRESS - NC 53 BUS	2.1	--	--	1.3	--	--	(10500)	N/A	3000	K	18.0	K	60.0
NC 53 BUS - WALLACE	0.6	--	--	0.4	--	--	(10500)	N/A	2000	K	18.0	K	60.0
WALLACE ST (SR 1344)	1.6	6.0	N/A	1.0	20	N/A	(10500)	1700	2500	K	18.0	K	60.0
WILMINGTON ST (SR 1510)													
WRIGHT-US 117	1.3	13.2	N/A	0.8	44	N/A	(24000)	1800	2700	ADQ	18.0	ADQ	60.0
WRIGHT ST													
DAVIE-WILMINGTON	0.6	10.8	18	0.4	36	60	18000	1000	1500	ADQ	ADQ	ADQ	ADQ
WILM-SATCHWELL	0.5	15.9	18	0.3	53	60	24000	1400	2000	ADQ	ADQ	ADQ	ADQ

Appendix B

RECOMMENDED SUBDIVISION ORDINANCES

Note: English equivalents are printed in this report merely as a guide. The English measurements were not meant to represent exact conversions, and should not be used for standards, regulations, or construction. The tables in this section were taken from the Roadway Design Metric Design Manual. In the event of conflicting information, the Standard Specifications for Roads and Structures and the Roadway Design Metric Design Manual should serve as the standard.

Appendix B

RECOMMENDED SUBDIVISION ORDINANCES

DEFINITIONS

I. Streets and Roads

A. Rural Roads

1. Principal Arterial - A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.

2. Minor Arterial - A rural roadway joining cities and larger towns and providing intra-state and inter-county service at relatively high overall travel speeds with minimum interference to through movement.

3. Major Collector - A road which serves major intra-county travel corridors and traffic generators and provides access to the Arterial system.

4. Minor Collector - A road which provides service to small local communities and traffic generators and provides access to the Major Collector system.

5. Local Road - A road which serves primarily to provide access to adjacent land, over relatively short distances.

B. Urban Streets

1. Major Thoroughfares - Major thoroughfares consist of Inter-state, other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.

2. Minor Thoroughfares - Minor thoroughfares perform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through traffic movements and may also serve abutting property.

3. Local Street - A local street is any street not on a higher order urban system and serves primarily to provide direct access to abutting land.

C. Specific Type Rural or Urban Streets

1. Freeway, expressway, or parkway - Divided multilane roadways designed to carry large volumes of traffic at high speeds. A freeway provides for continuous flow of vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. An expressway is a facility with full or partial control of access and generally with grade separations at major intersections. A parkway is for non-commercial traffic, with full or partial control of access.

2. Residential Collector Street - A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.

3. Local Residential Street - Cul-de-sacs, loop streets less than 760 meters (2500 ft) in length, or streets less than 1.6 kilometers (1.0 miles) in length that do not connect thoroughfares, or serve major traffic generators, and do not collect traffic from more than 100 dwelling units.

4. Cul-de-sac - A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.

5. Frontage Road - A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.

6. Alley - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

II. Property

A. Building Setback Line - A line parallel to the street in front of which no structure shall be erected.

B. Easement - A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

C. Lot - A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. The word "lot" includes the words "plat" and "parcel".

III. Subdivision

A. Subdivider - Any person, firm, corporation or official agent thereof, who subdivides of develops any land deemed to be a subdivision.

B. Subdivision - All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development and all divisions of land involving the dedication of a new street or change in existing streets; provided, however, that the following shall not be included within this definition nor subject to these regulations: (1) the combination or re-combination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein; (2) the division of land into parcels greater than 4 hectares (10 acres) where no street right-of-way dedication is involved, (3) the public acquisition, by purchase, of strips of land for the widening or the opening of streets; (4) the division of a tract in single ownership whose entire area is no greater than 0.8 hectares (2 acres) into not more than three lots, where no street right-of-way dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

C. Dedication - A gift, by the owner, of his property to another party without any consideration being given for the transfer. The dedication is made by written instrument and is completed with an acceptance.

D. Reservation - Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

DESIGN STANDARDS

I. Streets and Roads

The design of all roads within the Planning Area shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway Officials' (AASHTO) manuals.

The provision of street rights-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted by the municipality.

The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

A. Right-of-way Widths - Right-of-way (ROW) widths shall not be less than the following and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

	Min. ROW	
1. Rural		
a. Principle Arterial		
Freeways	105 m	(350 ft)
Other	60 m	(200 ft)
b. Minor Arterial	30 m	(100 ft)
c. Major Collector	30 m	(100 ft)
d. Minor Collector	24 m	(80 ft)
e. Local Road	18 m[1]	(60 ft)
2. Urban		
a. Major Thoroughfare other than Freeway and Expressway	27 m	(90 ft)
b. Minor Thoroughfare	21 m	(70 ft)
c. Local Street	18 m[1]	(60 ft)
d. Cul-de-sac	Variable[2]	

The subdivider will only be required to dedicate a maximum of 30 meters (100 ft) of right-of-way. In cases where over 30 meters (100 ft) of right-of-way is desired, the subdivider will be required only to reserve the amount in excess of 30 meters (100 ft). On all cases in which right-of-way is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principle and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width right-of-way, not less than 18 meters (60 ft) in width, may be dedicated when

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[1] The desirable minimum right-of-way (ROW) is 18 meters (60 ft). If curb and gutter is provided, 15 meters (50 ft) of ROW is adequate on local residential streets.

[2] The ROW dimension will depend on radius used for vehicular turn around. Distance from edge of pavement of turn around to ROW should not be less than distance from edge of pavement to ROW on street approaching turn around.

adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is sub-divided, the remainder of the full required right-of-way shall be dedicated.

B. Street Widths - Widths for street and road classifications other than local shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. Local Residential
   Curb and Gutter section: 7.8 meters (26 ft), face to face of curb
   Shoulder section: 6.0 meters (20 ft) to edge of pavement, 1.2 meters (4 ft) for shoulders

2. Residential Collector
   Curb and Gutter section: 10.2 meters (34 ft), face to face of curb
   Shoulder section: 6.0 meters (20 ft) to edge of pavement, 1.8 meters (6 ft) for shoulders

C. Geometric Characteristics - The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under Right-of-Way shall apply.

1. Design Speed - The design speed for a roadway should be a minimum of 10 km/h (5 mph) greater than the posted speed limit. The design speeds for subdivision type streets shall be:

DESIGN SPEEDS (METRIC)			
Facility Type	Design Speed km/h Desirable	Minimum Level	Rolling
RURAL			
Minor Collector Roads (ADT Over 2000)	100	80	60
Local roads including Residential Collectors and Local Residential (ADT Over 400)	80	80	60
URBAN			
Major Thoroughfares other than Freeway or Expressway	100	60	60
Minor Thoroughfares	100	50	50
Local Streets	50	50	30

DESIGN SPEEDS (ENGLISH)			
Facility Type	Design Speed mph Desirable	Minimum Level	Rolling
RURAL			
Minor Collector Roads (ADT Over 2000)	60	50	40
Local roads including Residential Collectors and Local Residential (ADT Over 400)	50	* 50	* 40
URBAN			
Major Thoroughfares other than Freeway or Expressway	60	50	40
Minor Thoroughfares	40	30	30
Local Streets	30	**30	**20

* Based on ADT of 400-750. Where roads serve a limited area and small number of units, can reduce min design speed.

**Based on projected ADT of 50-250.
(Reference NCDOT Roadway Design Manual page 1-1B)

2. Maximum and Minimum Grades

a. The maximum grades in percent shall be:

MAXIMUM VERTICAL GRADE (METRIC)

Facility Type	Design Speed (km/h)	Maximum Grade (Percent) Flat	Rolling	Mountainous
RURAL				
Minor Collector Roads*	30	7	10	12
	50	7	9	10
	65	7	8	10
	80	6	7	9
	100	5	6	8
	110	4	5	6
Local roads including Residential Collectors and Local Residential Streets*	30	-	11	16
	50	7	10	14
	65	7	9	12
	80	6	8	10
	100	5	6	-
URBAN				
Major Thoroughfares other than Freeway or Expressway	50	8	9	11
	65	7	8	10
	80	6	7	9
	100	5	6	8
Minor Thoroughfares*	30	9	12	14
	50	9	11	12
	65	9	10	12
	80	7	8	10
	100	6	7	9
	110	5	6	7
Local Streets*	30	-	11	16
	50	7	10	14
	65	7	9	12
	80	6	8	10
	100	5	6	-

* For streets and roads with projected annual average daily traffic less than 250 or short grades less than 150 meters (500 ft) long, grades may be 2% steeper than the values in the above table.

(Reference NCDOT Roadway Metric Design Manual page 1-12 T-3)

MAXIMUM VERTICAL GRADE (ENGLISH)				
Facility Type	Design Speed (mph)	Maximum Grade (Percent) Flat	Rolling	Mountainous
RURAL				
Minor Collector Roads*	20	7	10	12
	30	7	9	10
	40	7	8	10
	50	6	7	9
	60	5	6	8
	70	4	5	6
Local roads including Residential Collectors and Local Residential Streets*	20	-	11	16
	30	7	10	14
	40	7	9	12
	50	6	8	10
	60	5	6	-
URBAN				
Major Thoroughfares other than Freeway or Expressway	30	8	9	11
	40	7	8	10
	50	6	7	9
	60	5	6	8
Minor Thoroughfares*	20	9	12	14
	30	9	11	12
	40	9	10	12
	50	7	8	10
	60	6	7	9
	70	5	6	7
Local Streets*	20	-	11	16
	30	7	10	14
	40	7	9	12
	50	6	8	10
	60	5	6	-

b. Minimum grade should not be less than 0.5% .

c. Grades for 30 meters (100 ft) each way from intersections (measured from edge of pavement) should not exceed 5%.

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* For streets and roads with projected annual average daily traffic less than 250 or short grades less than 150 meters (500 ft) long, grades may be 2% steeper than the values in the above table.

(Reference NCDOT Roadway Design Manual page 1-12 T-3)

3. Minimum Sight Distance - In the interest of public safety, no less than the minimum sight distance applicable shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the following parameters:

SIGHT DISTANCE (METRIC)					
Design Speed (km/h)	30	50	60	90	100
Stopping Sight Distance					
Minimum (meters)	29.6	57.4	74.3	131.2	157.0
Desirable (meters)	30	70	90	170	210
Minimum K* Value for:					
Crest curve	3	9	14	43	62
Sag curve	4	11	15	30	37
Passing Sight Distance:					
Minimum Passing Dist for two lanes, in m	*	*	*	*	*

(General practice calls for vertical curves to be multiples of 10 meters. Calculated lengths shall be rounded up in each case.)
* Currently under revision.
(Reference NCDOT Roadway Metric Design Manual page 1-12 T-1)

SIGHT DISTANCE (ENGLISH)				
Design Speed, MPH	30	40	50	60
Stopping Sight Distance:				
Minimum (ft.)	200	275	400	525
Desirable (ft.)	200	325	475	650
Minimum K* Value for:				
Crest Curve	30	60	110	190
Sag Curve	40	60	90	120
Passing Sight Distance:				
Minimum Passing Distance for 2 lanes, in feet	1,100	1,500	1,800	2,100

(General practice calls for vertical curves to be multiples of 50 feet. Calculated lengths shall be rounded up in each case.)
(Reference NCDOT Roadway Design Manual page 1-12 T-1)

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* K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length of the vertical curve which will provide the desired sight distance. Sight distance provided for stopped vehicles at intersections should be in accordance with "A Policy on Geometric Design of Highways and Streets, 1990".

4. The "Superelevation Table" shown below shows the minimum radius and the related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter is 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

SUPERELEVATION TABLE (METRIC)		
Design Speed	Maximum e*	Minimum Radius m
50 km/h	0.04	100
65	0.04	175
80	0.04	280
100	0.04	490
50	0.06	90
65	0.06	160
80	0.06	250
100	0.06	435
50	0.08	80
65	0.08	145
80	0.08	230
100	0.08	395

e = rate of roadway superelevation, meter per meter

SUPERELEVATION TABLE (ENGLISH)			
Design Speed	Maximum e*	Minimum Radius ft.	Max. Deg. of Curve
30 mph	0.04	302	19 00′
40	0.04	573	10 00′
50	0.04	955	6 00′
60	0.04	1,637	3 45′
30	0.06	273	21 00′
40	0.06	521	11 15′
50	0.06	955	6 45
60	0.06	1,432	4 15′
30	0.08	260	22 45′
40	0.08	477	12 15′
50	0.08	819	7 30′
60	0.08	1,146	4 45′

* e = rate of roadway superelevation, foot per foot
(Reference NCDOT Roadway Design Manual page 1-12 T-6 thru T-8)

D. Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty-five (65) degrees.

2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.

3. Off-set intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 60 meters (200 ft) between survey center lines.

E. Cul-de-sacs

Cul-de-sacs shall not be more than 150 meters (500 ft) in length. The distance from the edge of pavement on the vehicular turn around to the right-of-way line should not be less than the distance from the edge of pavement to right-of-way line on the street approaching the turn around. Cul-de-sacs should not be used to avoid connection with an existing street or to avoid the extension of an important street.

F. Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provisions are made for service access. Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.

2. The width of an alley shall be at least 6.0 meters (20 ft).

3. Dead end alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turn around facilities at the dead end as may be required by the Planning Board.

G. Permits For Connection To State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is

available at the office of the District Engineer of the Division of Highways.

H. Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 9.0 meters (30 ft) from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 1.8 meters (6 ft) from the face of curb.

I. Wheel Chair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

J. Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2 lane, 2 way traffic should be as follows:

a. Shoulder section approach

i. Under 800 ADT design year

Minimum 8.4 meters (28 ft) width face to face of parapets, rails, or pavement width plus 3.0 meters (10 ft), whichever is greater.

ii. 800 - 2000 ADT design year

Minimum 10.2 meters (34 ft) width face to face of parapets, rails, or pavement width plus 3.6 meters (12 ft), whichever is greater.

iii. Over 2000 ADT design year

Minimum width of 12 meters (40 ft), desirable width of 13.2 meters (44 ft) width face to face of parapets or rails.

b. Curb and gutter approach

i. Under 800 ADT design year

Minimum 7.2 meters (24 ft) face to face of curbs.

ii. Over 800 ADT design year

Width of approach pavement measured face to face of curbs.

Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet or rail shall be a minimum of 450 millimeters (1' 6"), or greater if sidewalks are required.

2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic should be as follows:

a. Shoulder section approach - Width of approach pavement plus width of usable shoulders on the approach left and right. (Shoulder width 2.4 m (8 ft) minimum, 3.0 m (10 ft) desirable.)

b. Curb and gutter approach - Width of approach pavement measured face to face of curbs.

APPENDIX C

Description of status abbreviations[1]

North Carolina Status:

CODE	STATUS	DEFINITION
E	ENDANGERED	Any species or higher taxon of plant whose continued existence as a viable component of the States flora is determined to be in jeopardy (GS 19B 106: 202.12). (Endangered species may not be removed from the wild except when a permit is obtained for research, propagation, or rescue which will enhance the survival of the species).
T	THREATENED	Any resident species of plant which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (GS 19B 106: 202.12). (Regulations are the same as for Endangered Species).
SC	SPECIAL CONCERN	Any species of plant in North Carolina which requires monitoring but which may be collected and sold under regulations adopted under the provisions of the Plant Protection and Conservation Act (GS 19B 106:202.12). (Special Concern species which are not also listed as Endangered or Threatened may be collected from the wild and sold under specific regulations. Propagated material only of Special Concern species which are also listed as Endangered or Threatened may be traded or sold under specific regulations.)
C	CANDIDATE	Species which are very rare in North Carolina, generally with 1-20 populations in the state, generally substantially reduced in numbers by habitat destruction (and sometimes also by direct exploitation or disease). These species are also either rare throughout their ranges (fewer than 100 populations total) or disjunct in North Carolina from a main range in a different part of the country or world. Also included are species which may have 20-50 populations in North Carolina, but fewer than 50 populations worldwide. These are species which have

		the preponderance of their distribution in North Carolina and whose fate depends largely on their conservation here. Also included are many species known to have once occurred in North Carolina but with no known extant occurrences in the state (historical or extirpated species); if these species are relocated in the state, they are likely to be listed as Endangered or Threatened. If present land use trends continue, candidate species are likely to merit listing as Endangered or Threatened.
SR	SIGNIFICANTLY RARE	Species which are very rare in North Carolina, generally substantially reduced in numbers by habitat destruction (and sometimes also by direct exploitation or disease). These species are generally more common somewhere else in their ranges, occurring in North Carolina peripherally to their main ranges, mostly in habitats which are unusual in North Carolina. Also included are some species with 20-100 populations in North Carolina, if they also have only 50-100 populations rangewide and are declining.
W	WATCH LIST	Any other species believed to be rare and of conservation concern in the state but warranting active monitoring at this time.
P	PROPOSED	A species which has been formally proposed for listing as Endangered, Threatened, or Special Concern, but has not yet completed the legally mandated listing process.

United States Status:

CODE	STATUS	DEFINITION
E	ENDANGERED	A taxon which is in danger of extinction throughout all or a significant portion of its range (Endangered Species Act, Section 3).

T	THREATENED	A taxon which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (Endangered Species Act, Section 3).
C1	CANDIDATE 1	Taxa for which the Fish and Wildlife Service has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened. Development and publication of proposed rules on these taxa are anticipated; however, because of the large number of Category 1 taxa, it will take several years to clear the backlog.
C2	CANDIDATE 2	Taxa for which there is some evidence of vulnerability, but for which there are not enough data to support listing proposals at this time... Further biological research and field study usually will be necessary to ascertain the status of these taxa... It is likely that some category 2 candidates will not warrant listing, while others will be found to be in greater danger of extinction than some taxa in category 1.
3A	CANDIDATE 3A	Taxa for which the Fish and Wildlife Service has persuasive evidence of extinction. If rediscovered, such taxa might acquire high priority for listing.
3B	CANDIDATE 3B	Names that, on the basis of current taxonomic understanding ... do not represent distinct taxa...
3C	CANDIDATE 3C	Taxa that have proven to be more abundant or widespread than previously believed and/or those that are not subject to any identifiable threat. If further research or changes in habitat indicate a significant decline in any of these taxa, they may be reevaluated for possible inclusion in categories 1 or 2.

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P	PROPOSED	Taxa already proposed to be listed as endangered or threatened. Taxa formally proposed as endangered or threatened receive some legal protection. Species listed as proposed candidates are species which are in the process of being added to the federal candidate list.
*	POSSIBLY EXTINCT	Taxa with no known extant occurrences.

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1. Natural Heritage Program List of the Rare Plants of North Carolina. U. S. Fish and Wildlife Service 1990 (with amendments 1993).